COMPETITIVE POSITION of the MIDWESTERN EGG INDUSTRY

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U.S. DEPARTMENT OF AGRICULTURE — ECONOMIC RESEARCH SERVICE

PREFACE

The Department of Agriculture was given special funds in the fiscal year ending June 30, 1965, for a study of Midwestern egg prices and the factors which affect them. This study has been continued in succeeding years under regular funds. The market for eggs is nationwide. Therefore, to study the competitive position of any region in producing and marketing, it is necessary to study the industry in other regions as well.

This report presents the results of the first phase of the study of interregional competition in eggs. It brings together the results of previous studies, presents available statistical evidence and outlines some of the problems faced by the Midwestern egg industry in its attempt to maintain its historical role as the "egg basket of the Nation." Later phases of the work will explore in detail (1) the structure and practices of the industry in various regions and (2) the possible future characteristics and regional shifts in the egg industry, given certain specified changes in the producing, input-supplying, and marketing segments.

This program of research is being conducted through a coordinating committee of three divisions of the Economic Research Service. George B. Rogers of the Marketing Economics Division is chairman. The following people have conducted one or more phases of the work: George B. Rogers, Gene F. Miller, and Robert M. Conlogue, Marketing Economics Division; Herman Bluestone and Anthony S. Rojko, Economic and Statistical Analysis Division; and Everett O. Stoddard and Edward J. Smith, Farm Production Economics Division.

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SUMMARY

The Midwest has been the traditional "egg basket" of the Nation since the late 1800's, when developments in refrigeration made it feasible to ship eggs East. By the 1920's and 1930's, commercial areas, mainly in the Northeast and on the Pacific Coast, were providing substantial competition to the Midwest. But the Midwest remained the primary place where deficit areas could fill needs for eggs which local production could not supply.

In the last decade, the Midwest has been increasingly challenged by the rise of a new egg industry in the South and intensified commercial developments in some older egg-producing regions. As a result, total egg production in the East and West North Central Regions has declined since the mid-1950's. In contrast, output has increased in the South Atlantic, South Central, and Western Regions.

The Midwestern egg industry, originally founded on sideline flocks on general farms, has remained more of a small and scattered flock area than many other regions. It has also continued to produce and market with a minimum of coordination of the producing, input-supplying, and marketing functions. Marketing channels have remained somewhat longer and more complex. In some instances, seasonal competition from breaking outlets has hindered the development of year-round outlets for table eggs.

Small and scattered flocks mean relatively higher costs for delivering production inputs, such as chicks and feed, and for assembling eggs for packing plants. Small lots are also more costly to handle at mills, hatcheries, and egg-packing plants. Small flocks may also produce eggs which are of lower average quality.

Recent cost studies have determined that economies of scale exist in egg-packing, feed-milling, and chick-hatchery operation. That is, up to the limits of present technology and at similar rates of utilization of potential capacity, average cost per unit handled declines as plant size increases. However, these potential economies of scale can be achieved to the greatest extent in areas where the density of production is greatest. The reason for this is that plants must consider both the inplant costs and the costs of hauling the product between plant and farms. Larger plants are most feasible when hauling costs are low. With a lower average density of production, the Midwest has relatively more and smaller firms and, thus, higher average costs.

In many areas, producers and assembler-distributors are making more deliveries direct to retail stores and warehouses, shortening the egg-marketing channels appreciably. Such deliveries bypass wholesale receivers and distributors located in terminal markets. The Midwest, however, is still moving a large share of its eggs through the longer and costlier marketing channels.

The Midwest, potentially, has an advantage in production costs for feed, since many major feed ingredients are produced in the area or near it. However, except where homegrown and local ingredients are used, Midwestern producers apparently do not pay less for feeds than other areas. Wage rates are higher in the Midwest than in the South, though the differences between the regions may be narrowing. Chick prices in the Midwest are higher than in some other areas.

The egg industry has been characterized by a relatively slow rate of growth, mainly due to the decline in the per capita demand for eggs. This decline in demand has more than offset the decline in egg prices that was made possible by improvements in production and marketing processes.

Thus, the worsening competitive position of the Midwest has been intensified by the slow rate of growth of aggregate output of eggs as well as by its failure to adopt cost-reducing innovations as rapidly as other areas.

If the Midwestern egg industry is to avoid further loss of its share of the Nation's egg business, it will have to make substantial changes. Some firms have already begun to change their traditional ways of doing business. But further changes in the size and location of producing units, in the input-supplying industries, and in marketing practices and channels are needed. Otherwise, the Midwest may continue to lose out to other areas.

The Midwest will need to improve egg quality, develop greater production density, and have larger flocks. Increased coordination of producing, input-supplying, and marketing functions is needed. Such complexes can do a better job of supplying regular outlets with the kinds and quantities of eggs they need, whether the outlet is for table eggs or breaking stock. More direct marketing channels can also result.

A primary determinant of the location of egg production is the return producers can get from egg production compared with other activities. If marketing costs in the Midwest can be lowered, the relative gross return to producers can be raised. If, also, production costs can be lowered, net returns can be raised. Thus, Midwestern producers might find egg production a better alternative, and others might be more willing to invest in the industry.

COMPETITIVE POSITION OF THE MIDWESTERN EGG INDUSTRY

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INTRODUCTION

Many egg producers in the Midwest have become increasingly concerned in recent years about the prices they receive for their eggs, particularly during the late spring and early winter when production is greatest. The growing dissatisfaction with producer price levels is an expression of some rather far-reaching troubles being experienced by the Midwestern egg industry.

These difficulties are attributable to both external and internal forces. Externally, the egg industry is characterized by a rate of growth which is slower than that of the population. The per capita consumption of eggs has been declining, even though egg prices have declined in relation to prices of most other food products. (See Appendix I for demand analyses.)

The effects of the new competition, primarily from the South, which the Midwest has experienced in the last decade, have been intensified by the slow rate of growth of aggregate production of eggs. Cost-reducing innovations, particularly those related to scale of operations and changes in industry structure, have been adopted much more readily in other areas than in the Midwest. These changes have contributed to a generally lower price level for eggs. This has meant that the net returns from egg production in the Midwest are less attractive than in previous decades.

This report outlines the basic characteristics of the U.S. egg industry and discusses some of the regional changes which have occurred over time. Using this as a background, the current situation of the Midwestern egg industry and its future prospects are evaluated in detail. Included in the report are summaries of previous research studies and recent comments from industry meetings, the trade press, and economists working on the egg industry. Results of special and new analyses made by the Economic Research Service are also shown.

Early Beginnings

The early development of egg production in this country was as a sideline enterprise on farms. Hence, numbers of laying hens tended to rise as the number of farms increased. Chickens were kept on most farms. The buildup of egg production in the Midwest began with rapid settlement of the area before and after the Civil War.

The growth of grain production in the Midwest, particularly in the West North Central Region, was a second factor tending to promote egg production in that area. By the late 1800's and early 1900's, about half of the Nation's hens were in the East North Central, the earliest area settled, and the West North Central Regions. Sizes of flocks also tended to average larger in the Midwest at that time than elsewhere.

By the 1920's and 1930's, commercial egg production had developed extensively in areas close to large concentrations of population, such as in the New England, Middle Atlantic, Pacific Coast, and some parts of the East North Central Regions. Thus, by the 1940's, flock sizes averaged larger in the Northeast and on the West Coast than in other areas. On the other hand, egg production in the Midwest and South continued to be predominantly a side-line enterprise. In the last decade, a new commercial egg industry emerged in the South and commercialization intensified in California and in some other older areas.

Regional Egg Production

Farm egg production in the United States totaled about 179 million cases in 1965. This was only 4 percent greater than the average production in 1957-59 and 16 percent greater than in 1947-49. The decade after World War II saw production increase only on the Atlantic Coast and in the far West. Elsewhere it stayed about the same. Since the late 1950's, however, egg production has increased rapidly in the South and West and declined sharply in other regions (table 1).

Egg production between 1957-59 and 1965 rose 54 percent in the South Atlantic States, 51 percent in the South Central States, and 38 percent in the West. But largely offsetting these large increases were declines of 31 percent in the West North Central States, 19 percent in the East North Central States, and 12 percent in the North Atlantic States.

These changes substantially altered the regional distribution of egg production. The three regions expanding egg production accounted for 53 percent of 48-State output in 1965 compared with 37 percent in 1957-59. During the same interval, the North Central Region's share of production fell from 45 percent to 32 percent.

Table 1.--Egg production, by regions, averages 1947-49, 1957-59, and annual 1965

Region	Total production			Per capita production for food 1/		
	1947-49	1957-59	1965	1947-49	1957-59	1965
	Million cases			Eggs		
North Atlantic	25.2	30.3	26.6	226	240	195
East North Central	31.9	31.9	25.8	371	314	239
West North Central	44.7	45.5	31.3	1,149	1,064	697
South Atlantic	13.2	19.1	29.4	215	231	317
South Central	23.7	23.3	35.2	331	269	356
Western	15.5	22.1	30.6	292	299	345
48-States	154.1	172.2	178.9	366	339	313

1/ Total production minus eggs used for hatching.

Regional changes in production were partly due to differences in the rate of population growth. In the 7 years through 1965, population increased 20 percent in the West, 15 percent in the South Atlantic States, and 11 percent in the South Central States, but it increased only 8 percent in the North Atlantic States, 7 percent in the East North Central States, and 6 percent in the West North Central States. In addition, eggs used for hatching expanded much more rapidly in the South and West than in other areas.

But, even apart from the production of eggs used for hatching, egg production in the expanding regions rose more rapidly than population. Output of eggs for food on a per capita basis increased 37 percent in the South Atlantic States, 32 percent in the South Central States, and 15 percent in the West. It declined sharply in all other regions. In 1957-59 per capita egg production for food in the West North Central Region averaged 1,064 eggs, or about 3 times as many as the national average, while per capita outputs in all other regions were below the U.S. average. But the regional shifts in egg production since the late 1950's have left the North Atlantic and East North Central Regions the only major egg deficit areas in the country.

The West North Central States, despite their rapidly shrinking output, still turned out 697 eggs per capita for food in 1965, about twice as many as the South Central States, the next ranking region.

Surplus-Deficit Status 1/

From 1925-29 to 1950-54, the North Central area, which contained about 30 percent of the U.S. population, produced about half the total U.S. output of eggs. Hence, the surplus of eggs over local needs was substantial. In the West North Central Region, the surplus increased between 1925-29 and 1950-54. From 1925 to 1929, five geographical areas showed an excess of production over consumption--East North Central, West North Central, West South Central, Mountain, and Pacific. By 1950-54, only the West North Central Region had a substantial excess of production over consumption.

However, an expansion of egg production occurred in the South and on the West Coast during the late 1950's and 1960's. This resulted in the Pacific Coast and East South Central States becoming surplus areas by 1960-61, and the South Atlantic States virtually self-sufficient by 1963-64.

There have been many shifts in the surplus-deficit positions of individual States during the past two decades, but only a few of these States are a threat to the competitive position of the Midwest. These States are Georgia, North Carolina, Alabama, Mississippi, and California, all of which have become self-sufficient or surplus producers.

Before World War II, only New Hampshire, Ohio, Indiana, Wisconsin, Delaware, Virginia, Oklahoma, Texas, California, Montana, Idaho, and Utah, in addition to the West North Central States, produced surpluses. After the war, Maine and Vermont, in northern New England, also became surplus States. In the East North Central area, Ohio had become deficit, while in the South Atlantic area, only Delaware remained a surplus State. New Jersey was a surplus State during the 1950's, while Texas became deficit. After World War II, the Pacific Coast States, as well as the Mountain States, were deficit.

Midway through the 1950's, North Carolina emerged as a surplus State. Kentucky and Oklahoma became deficit; Oregon went from surplus to deficit; Washington became a surplus State. In the late 1950's and early 1960's, California moved from a substantially deficit to a substantially surplus position. With Utah shifting from surplus to deficit, Idaho remained the only Mountain State with a small surplus. Mississippi, Alabama, Georgia, South Carolina, and Arkansas emerged as surplus States. Northern New England, Indiana, and Wisconsin remained surplus. The West North Central States remained surplus, but the total amount of the surplus declined substantially.

Predominant Movements of Eggs

Figure 1 shows the estimated surplus-deficit positions of States in 1964. This emphasizes the fallibility of drawing conclusions strictly on the basis of traditional regional boundaries. It also emphasizes that State figures provide a better basis for indicating predominant geographical movements of eggs.

1/ Surplus-deficit estimates assume that the per capita consumption of eggs for food is the same in each State. Estimates of eggs used for hatching in each State are based on the number of chicks hatched within the State.

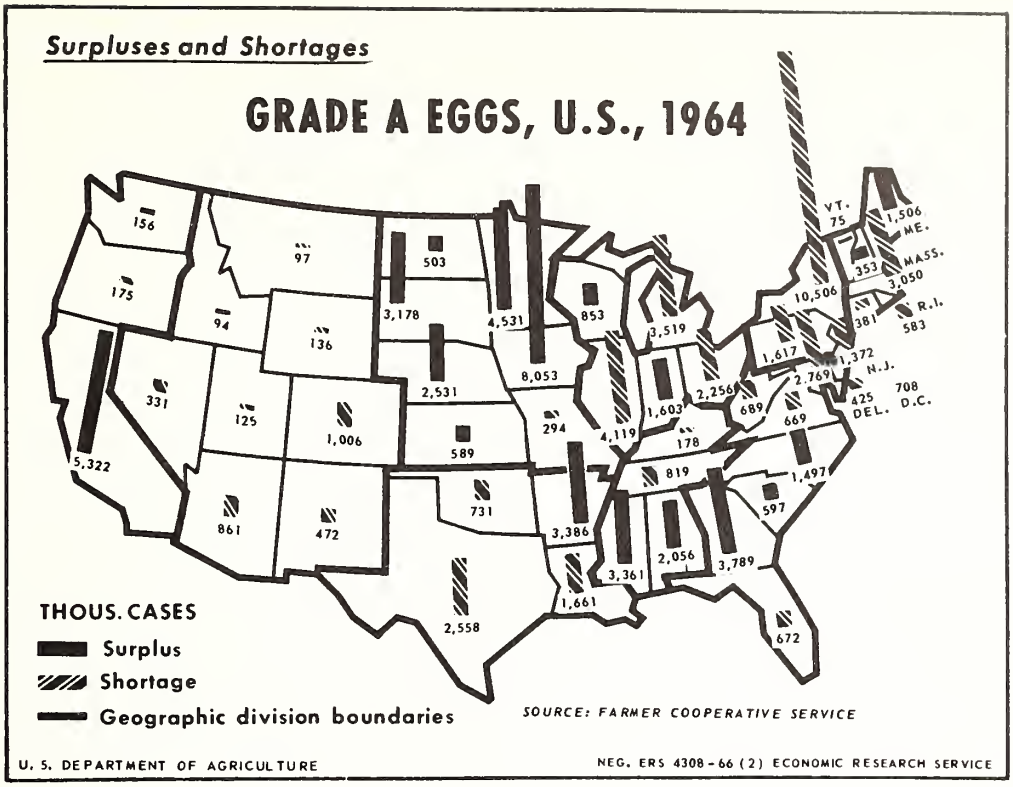

Figure 1

The 12 leading egg-producing States are California, Iowa, Pennsylvania, Georgia, Minnesota, Texas, Ohio, North Carolina, Indiana, Illinois, Alabama, and Arkansas. However, the leading surplus egg-producing States are Iowa, California, Minnesota, Georgia, Arkansas, Mississippi, South Dakota, Nebraska, Alabama, Maine, and North Carolina. The principal areas which are deficit in egg production are Southern New England, New York, Pennsylvania, New Jersey, Delaware, Maryland, Virginia, West Virginia, Kentucky, Tennessee, Ohio, Michigan, Illinois, most of the Mountain States, the West South Central area, and Florida. Thus, eggs move mainly east and west from the West North Central States, north and west from the Southeast, and east from California.

Farm Egg Prices

Egg prices received by farmers, as reported by the Crop Reporting Service, are averages for eggs of all grades and sizes, sold at all marketing levels, and used for food and other purposes such as hatching. In 1965 prices by regions varied from 24.4 cents per dozen in the West North Central Region to 39.7 cents in the North Atlantic Region. Since egg quality, utilization, and marketing practices differ widely among regions, prices received by farmers for eggs do not provide a good measure of regional differences in prices of any specific kind or grade of eggs. However, changes in average prices received by farmers over time do show changes in the price level of eggs among regions (table 2).

Table 2.--Prices received by farmers for eggs, by regions, 1947-49, 1957-59, and 1965

Region	Average price per dozen			Percentage change, 1957-59 to 1965
	1947-49	1957-59	1965	
	Cents			Percent
North Atlantic	58.8	44.0	39.7	-9.8
East North Central	43.4	31.7	30.2	-4.7
West North Central	38.4	27.1	24.4	-10.0
South Atlantic	50.1	43.7	39.1	-10.5
South Central	42.5	36.7	37.4	+1.9
Western	52.2	36.5	30.8	-15.6
United States	45.9	35.3	33.7	-4.5

Between 1947-49 and 1965, prices received by farmers for all eggs in the 48 States declined 12 cents per dozen, or from 45.9 to 33.7 cents. Technical advances and structural and organizational changes reduced production costs, while, at the same time, demand declined. Most of the decline in egg prices occurred from 1945 to 1955. Since 1957-59, the South Central Region has been the only region to avoid a downtrend in average prices for eggs. This appears due to changes of States in surplus-deficit status in both directions and to changes in the structure of the industry. Prices received by U.S. farmers declined 10-16 percent over the past 7 years in the North Atlantic, South Atlantic, West North Central, and Western Regions and 5 percent in the East North Central Region.

SEASONALITY OF EGG PRODUCTION AND PRICES 2/

Egg production in the United States is highest in March-May and lowest in August-November. During the 4 months of high output, monthly egg production tends to run about 9 percent above average and in the 4 months of low output, about 5 to 8 percent below average. These measures of seasonal variation are not adjusted for differences in the length of months.

2/ See Appendix II for indexes of seasonal variation.

Since the demand for eggs for current use is inelastic, the seasonally changing production tends to give rise to corresponding but opposite changes in egg prices. Price changes tend to lag a little behind the production changes and the peaks and troughs tend to be more pronounced in prices than in production. Egg prices are lowest in the spring and early summer and highest in the fall and winter. Average prices received by farmers for all eggs in the United States, when seasonally low in April-July, tend to be about 10 percent below the annual average and when seasonally high in September-December about 7 percent above average. The monthly price is usually lowest in June and highest in October.

The prospective drop in spring egg prices and the rise in fall and winter prices are moderated somewhat by the movement of eggs or egg products into and out of storage. During the spring when egg production exceeds current requirements and egg prices are lowest, the bulk of the surplus shell eggs over current needs is converted to frozen and dried egg products for sale in the fall and winter when prices are highest. The demand for storage supports prices in the spring and the sale of storage stocks moderates the rise in prices in the fall and winter.

With the seasonal variation in production reduced, the seasonal rise in egg prices has decreased over the last two decades, in terms of cents per dozen. Storage of egg products is now much more important in relation to storage of shell eggs. A substantial rise in the price level of shell eggs is needed to make their storage profitable because shell eggs deteriorate in quality and value while being refrigerated. Profitable storage of egg products, on the other hand, requires only a small rise in the level of egg prices, because storage costs per egg equivalent are lower and because the spring pack of frozen eggs is generally of better than average quality, which is retained in storage. Normally, top grade eggs are not used for breaking to any large extent except in the spring when supplies are heaviest.

Egg production currently fluctuates less than the rate of lay per bird because the seasonal movement in layer numbers is partially offsetting, except in the summer. In the spring the rate of lay increases rapidly and more than offsets the decline in layer numbers. In the late summer and early fall, it decreases and more than offsets the advance in layer numbers. In the summer, both the rate of lay and the number of layers decrease.

The seasonal swings in egg production have been reduced over the last few decades. Most of the reduction has been achieved through changes in the rate of lay rather than through changes in layer numbers. Chickens have been induced to lay more eggs in the fall in a number of ways. First, poultrymen have used lights and other devices in henhouses to duplicate or improve upon the ideal conditions for egg production that naturally exist in the spring. Second, breeders have developed strains and crosses which maintain high production throughout the year. Third, researchers have developed better feeds and disease-control measures. And fourth, in recent years, egg producers have been starting more and more of their replacement chicks outside the traditional spring period.

The seasonal variation in egg production over the next decade is expected to decrease further. This probably will reduce the spring-to-fall rise in prices for eggs and egg products so that regular seasonal storage will disappear.

Egg production displays a seasonal pattern in all regions, with output highest in the spring and lowest in the fall. However, seasonal swings are about twice as wide in the West North Central States and the South Central States as in the country as a whole. These regions also have a more variable rate of lay than average. Egg production in the West North Central Region tends to be 11 to 16 percent above average in March-May and 11-17 percent below average in August-October. Layer numbers in the West North Central Region vary more than in other regions because the hatch of flock replacement chicks in this region is compressed into a smaller number of months. For instance, in 1965 some 87 percent of the egg-type chicks in the West North Central Region were hatched in the first half of the year compared with 65 percent for the United States as a whole.

The South Central Region tends to have a peak in egg production similar to the West North Central Region, 13 to 15 percent above average in March-May but a less pronounced trough, 8 to 9 percent below average, in November-December. In the South Central Region, layer numbers are less variable than for the country as a whole.

The West has by far the most even monthly production pattern, varying from about 5 percent above average in May to 4 percent below average in November. February output is actually 8 percent smaller than average but this is due to the shortness of the month.

The variability of prices received by farmers for all eggs does not differ as much by regions as egg production. This would be expected since eggs move readily from one region to another when differences in egg prices exceed transportation costs. Thus, the cost of transporting eggs sets a limit on how much egg prices can vary by regions. Over the last decade, the fluctuation in egg prices measured in cents per dozen has decreased considerably, but variability in terms of percentage has not changed much for the United States as a whole because of the decline in the level of egg prices. However, percentage changes in egg prices in the Pacific States increased considerably during this period.

Prices received by farmers reach their peak in all regions in the fourth quarter, except in the Pacific Region where prices are highest in the first quarter. They are lowest in all regions in late spring and early summer.

The regions with the most seasonal variability in egg production are not necessarily the ones having the most variability in egg prices. Egg prices in the West North Central Region, where egg production is most highly seasonal, vary the least, while egg prices fluctuate the most in the West, where the egg flow is the most even. Tables 22 and 23, Appendix II, show the variability in indexes of seasonal variation in egg prices and production by regions. The more stable prices in the West North Central States appear to result from the spring demand from seasonal egg breakers.

Monthly prices for specific grades and sizes of eggs were also studied. In markets east of the Rockies, large eggs fluctuate more in price than medium-sized eggs, but just the opposite pattern is evident in San Francisco. Medium-sized eggs tend to rise less between spring and fall in the East than in the West, possibly reflecting in part the greater seasonality of the replacement hatch in the East. In Eastern markets, medium-sized eggs are more plentiful than large eggs in the fall, when layers from spring-hatched chicks first come into production with smaller-than-average eggs.

Large and medium-sized eggs also differ in the shape of their seasonal price patterns. Large eggs usually reach a price peak in the fall, but medium-sized eggs reach a high in the winter, 2 to 3 months later.

CHARACTERISTICS OF THE DEMAND FOR EGGS

During the last decade, U.S. egg production has not kept pace with the percentage increase in U.S. population. As a result per capita consumption has declined 15 percent. During the same period, farm prices fell 13 percent and retail prices 12 percent (table 3). These changes represented a continuation of trends which began in the early 1950's.

Part of the decline in egg prices was due to lower production costs made possible by gains in technology and efficiency and changes in industry structure. However, total demand for eggs has also declined, causing prices to drop more than they would have from lower production costs alone.

The demand for eggs is inelastic, that is, a given percentage change in output results in a larger percentage change in prices. This causes a considerable variation in prices and net returns from year to year. Reduced returns in years of increased production tend to be offset by higher returns in years when production is reduced. However, the shift in demand to lower and lower levels has produced intensified and sustained downward pressures on returns, particularly those of smaller producers.

Most people consider eggs primarily a breakfast food, and the bulk of all shell eggs consumed are used during this meal. However, changes in the pattern of living and working in recent years have greatly affected the kinds of food eaten at breakfast. Fewer people are now engaged in strenuous work and, in general, do not feel the need for large breakfasts, the kind in which most homemakers use eggs. Some people avoid large breakfasts because they are dieting. More and more working wives probably have switched from serving eggs for breakfast to highly advertised breakfast cereals. They also use fewer eggs in home baking than their nonworking counterparts.

A series of statistical analyses were developed with annual data for 1955-64 (see Appendix I). These analyses indicated that major factors influencing the price of eggs were: (1) Per capita egg supplies for food; (2) per capita disposable income; and (3) a downward shift in demand over time. Prices vary inversely with supplies and directly with income, and decline in relation to any given volume with the passage of time. Per capita disposable income is tending upward, but this has not offset the downward shift in demand which has been occurring.

Table 3.--Production, prices, and per capita consumption of eggs, United States, 1947-49 to 1965

Years	Production of eggs	Farm price per dozen	BLS retail price Grade A, large per dozen	Civilian per capita disappearance
	Millions	Cents	Cents	Number
1947-49	55,479	45.9	70.5	385
1950-52	58,362	41.9	67.1	391
1953-55	58,796	41.3	63.0	375
1956-58	61,249	37.9	59.3	362
1959-61	62,302	34.3	55.9	338
1962-64	63,584	33.9	54.3	318
1965	64,588	33.7	52.7	308

The demand for processed eggs appears more inelastic than the demand for shell eggs. Most egg products are used in prepared foods. Since eggs are expensive compared with other ingredients, manufacturers tend to use minimal quantities. They rarely change these quantities in response to typical year-to-year price changes.

Over time, a larger proportion of total supplies is being used for processed products. Thus, aggregate demand may be more inelastic than formerly as the processed segment becomes of greater importance. Many surveys made at particular points in time have indicated that per capita consumption was not uniform in various regions. It was found to vary in particular studies with such factors as income level, family size, age, education, and cultural background (2, 3, 4, 5, 14, 18, 27, 72). 3/ However, with increased population mobility, more equal distribution of income, and other changes in population characteristics, some evening-out of previously observed differences may occur.

PREVIOUS STUDIES OF INTERREGIONAL COMPETITION ON EGGS

Several previous studies were made of interregional competition on eggs. Some of these, though of little help in accurately predicting future developments, provided important methodological advances. Some merely projected trends using secondary data. Others were simple transportation models. None of these approaches appear adequate or comprehensive enough. Trend study may

3/ Underscored numbers in parentheses are items listed in the Selected References, p. 40.

not properly anticipate changes due to new methods of producing and marketing eggs. Transportation is only one factor affecting the competitive position of a region. These earlier studies were deficient because: (1) Certain pertinent factors were entirely omitted from some analyses; (2) available knowledge of market structure and channels, prices, margins, quality, costs and efficiency, and various production and marketing interrelationships was inadequate; and (3) analytical techniques then available were inadequate to support complex models. A review of selected studies is presented below. It enables comparison of some of the conclusions reached with the present egg industry, and provides a basis on which to outline a more comprehensive approach for studying inter-regional competition on eggs.

Judge, Seaver, and Henry (40) discussed economic forces which determine the nature and degree of regional specialization and the geographic flow of factors and goods within and between regions. Three sets of structural relationships were specified: (1) Inequalities in the geographic distribution of resources and the resulting production possibilities which determine physical opportunities available to a firm or region; (2) geographic distribution of population and incomes; and (3) the market sector where the interaction of firm and household forces determines prices and factor price ratios. They listed, as dynamic forces which condition interregional competition, innovations which are biological, mechanical, or organizational. These can alter the absolute and relative advantages of various regions and sizes of firms. Changes in the location of population and in the distribution of income also affect regional production patterns and the amount of marketing services demanded.

Judge (39) developed a spatial equilibrium model for eggs which divided the United States into 12 regions. Basic data required for each region were: (1) Market demand relationships for eggs; (2) values of the predetermined variables, that is, supply of eggs, population, and disposable income; and (3) the flow-equilibrium solution, using equilibrium regional prices and consumption with regional production to derive interregional movements. In the flow-equilibrium solution, the West North Central and Northern Plain States were exporters of eggs. Other solutions dealt with the effects of 20 percent increases and decreases in transport costs, the impact of alternative price and income elasticities, the impact of a large egg supply, and 1952 and estimated 1959 conditions. Population and production changes to 1959 were projected, using changes from 1944-46 to 1951-53. On this basis, the West North Central and some of the Middle Atlantic and upper South Atlantic States were exporters.

Christensen and Mighell (16) reviewed the factors affecting egg production and consumption and the trends from 1925 to 1949 in output, costs, and efficiency in different areas. Projection of these trends did not indicate any drastic shifts in the location of egg production.

Stemberger (74) studied the competitive position of North Carolina with reference to out-of-State egg markets. He concluded that eggs were a profitable alternative for North Carolina producers and that the State could produce and market eggs as cheaply as their Midwestern competitors. While the Midwest had an advantage in lower feed costs, hired labor and housing costs were lower in North Carolina. Moreover, as a newer area, North Carolina could organize to obtain cost advantages in egg assembly. He concluded that the best markets for

North Carolina were Baltimore, Washington, D.C., and the coastal cities of Virginia, with Philadelphia, New York, Boston, and other Northeastern cities somewhat less profitable. Several transportation problems were solved with the national market system represented by 40 surplus and 48 deficit areas. Solutions were obtained for 1954 and 1957. For each year, North Carolina was assumed to be surplus; in another model the Southeast was assumed to be self-sufficient.

Hertsgaard (30) investigated interregional shipments of eggs among 18 regions, using a transportation model analysis applied to data for 1950-58 and to estimates for 1975. Projections for 1975, assuming production in each region increased by a fixed percentage over 1958, indicated major movements similar to those for 1950-58. These movements were east, west, and south from the Midwest. When production trends for 1950-58 were projected to 1975, movements were similar except that Washington and California were surplus and shipped for short distances east to the Mountain and Southwestern States.

In another study (29), Hertsgaard used linear programming to explore comparative advantage relationships among 15 producing regions in the production of beef, pork, broilers, turkeys, and eggs for consumption in each of four consuming regions. Data used were estimated costs of production for each product in each region, costs of transportation between all pairs of regions, supplies of feed in producing regions, and regional consumption estimates. The analysis suggested that egg production would be oriented to low feed costs. North Dakota, Minnesota, and parts of Wisconsin and Michigan had only slight disadvantages in the production of eggs for the North Central States, the Northeast, and the West. South Dakota had a slight advantage in producing eggs for these market areas. Iowa, Missouri, Kansas, and Nebraska also appeared in favorable positions to produce for these markets. Several Midwestern States also appeared in favorable positions to send eggs to the South.

Planting (59) evaluated the competitive position of 40 regions in egg production. He indicated egg producers in the South were in the strongest economic position because of low transportation costs for feed and generally good organization of marketing outlets. The economic position of the North Atlantic States was described as fairly good because the region is deficit and has good nearby markets which return higher prices than markets in other regions. Increasing population in the Pacific Coast should keep producers in a good position, but higher production and transportation costs would make distant shipments unlikely. The position of the Corn Belt and Plains States was described as potentially good, primarily because of low-cost feed. However, small flocks, inadequately organized market outlets, and varying quality of eggs were indicated as drawbacks which prevent these regions from realizing their full potential. Planting ranked the following areas highest on the basis of projected economic and competitive positions: North Carolina, South Carolina, North Georgia, Northern Alabama, Central Mississippi, and Southern California.

Seale (71) used 1958-60 as a base period to make projections to 1970 of the flows of eggs between 40 areas and a processing outlet. He developed costs of transporting eggs, supply and demand estimates, and equilibrium quantities, flows, and prices for the base and projected periods by reactive programming procedures. Supplies for 1958-60 were adjusted for eggs used for hatching and for nonfarm production. Supplies for 1970 were projected from changes from

1946 to 1960. Population changes were used to derive 1970 demand with 1958-60 equilibrium prices. Major flows in 1958-60 were from the West North Central States to the Northeast, Southeast, South Central, and Mountain States; from the Carolinas, Georgia, Mississippi, and Arkansas to adjacent States; from California to adjacent States; and from New Jersey to the adjacent States to the north. Projected flows for 1970 were similar, but with expanded flows from the Southeastern States toward the Northeast and Florida; from Arkansas, Mississippi, and Alabama toward the South Central area; from New Jersey and Pennsylvania toward adjacent States; and from California and the Pacific Northwest to adjacent States. The West North Central area was shown as shipping shorter distances east, west, and southeast.

Some of the earlier studies correctly anticipated the growth of the South as a major egg-producing region. Other projections overstated the advantages of regions such as the Midwest and the Northeast. On the whole, the studies by Planting (59) and by Seale (71) seemed to best express recent developments. In general, both studies were relatively recent and took into account more factors than some of the other analyses.

This report is built upon the base provided by the scope and findings of earlier studies. Previously noted factors, as well as additional ones, that affect the competitive position of a region are evaluated.

FACTORS AFFECTING THE COMPETITIVE POSITION OF A REGION

In considering quantitative analysis of interregional competition, it becomes apparent that available information is inadequate in several important respects. Lacking adequate data, the analyst can simplify the model he uses or substitute a substantial degree of subjective judgment for formalized mathematical procedure. Or, he can retain the complexity of his model and obtain and use additional information to better approximate coefficients and relationships.

A linear transportation model represents an oversimplified conception of how eggs should move, given certain surplus and deficit areas with attendant quantitative estimates and a pattern of transportation rates or costs. A forerunner of such a model applied to eggs can be found in the price control regulations issued during World War II by the Office of Price Administration and prepared on a standby basis during the Korean war by the Office of Price Stabilization. In those programs, prices were established at levels which would enable all areas to obtain equal per capita supplies, with deficit areas drawing from sources which would tend to minimize transportation movements. These programs, as well as linear models which more formally and accurately minimized aggregate transportation charges, often indicated movements which differed from current patterns. In both the programs and the linear models, quantities were usually given. The difficulty of obtaining full sets of going rates frequently led analysts to assume rail rate patterns. However, since most eggs now move by truck, it is questionable whether the aggregate transportation charges were really minimized by such models. It is possible that the use of linear transportation model with truck rates (or costs) would be more accurate.

It is also possible to develop estimates of production costs, and even estimates of marketing costs, to combine with other features of a transportation model. These estimates enable the analyst to derive minimum prices at which eggs can be supplied to various regions. In such analyses, the paucity of information on differences in consuming patterns by regions has often led to an assumption of uniform per capita consumption in all regions.

The likelihood remains, however, of some regional differences in the demands for eggs of various qualities and sizes. Moreover, the differences between regions in opportunities for the employment of human and material resources, and the relative returns from these alternatives, must also be considered. The attractiveness of alternative opportunities for producers may also differ with various flock sizes.

The demands for eggs of various grades and sizes within a particular region can be met from local production, or eggs can be shipped in from other producing areas. The particular alternative, or mixture of various alternatives, chosen depends on the prices paid for eggs. Prices to the producers are essentially residuals (in the short run) obtained by deducting costs of the primary and secondary marketing systems. In the primary system, the major charges are for assembling eggs from farms and for packing them at plants. In the secondary marketing system, they are long-distance transportation costs and distributing and retailing margins. Costs or charges in the primary and secondary marketing systems are affected by many factors.

In aggregate terms, the costs of a total regional system are determined primarily by three factors: (1) The number of separate participants or transactions; (2) distances involved in input-distribution, assembling the raw product, and distributing the final product; and (3) the level of internal efficiency in performing various functions. There are inescapable interrelationships between conditions in production, in the input-supplying industries, and in the performance of marketing services.

The net returns to the producers in any region are substantially affected by the costs of major production inputs. These costs, in turn, are affected by many factors. The net returns to producers with various sizes of flocks can be compared with those obtainable from alternative opportunities. The summations of these comparisons, at various prices for eggs, can be represented as supply response curves.

THE MIDWESTERN EGG INDUSTRY IN PERSPECTIVE

Using the framework developed in the preceding section, this section discusses the Midwestern egg industry, using mainly data available from previous studies and regular statistical series.

The Midwestern egg industry is faced with many problems in its efforts to compete with other regions. It has not achieved the levels of operating efficiency which empirical studies indicate are possible. Furthermore, its marketing and input-supplying systems appear less efficient than those in some

other areas. For example, the Midwest has many small flocks which pose problems of egg quality and higher assembly and plant costs. The industry has some favorable factors, however. Some of its problems and some of its favorable factors are discussed in this section.

Institutional Considerations

The attitude one encounters in many areas of the Midwest about the future of the egg industry is in sharp contrast to that in many areas of the South. Attitudes in the two areas reflect, to a large extent, recent experiences. The South has rapidly expanded its industry. It has been able to (1) capture many outlets in the South which formerly relied on eggs from the Midwest, and (2) establish itself as a competing supplier in the deficit Northeast.

As the long-standing major surplus region, the Midwestern industry tends to follow long-established patterns. The structure of the industry thus tends to restrict the adoption of cost-reducing changes. On the other hand, the Southern industry is new and not bound by precedents. In particular, the South has achieved a high degree of coordination of production, input-supplying, and marketing. In the Midwest, these functions are more autonomous.

As in any old and well-established industry, there are substantial committed investments. Until these reach a point where a decision for reinvestment is considered highly critical, the attitude of many people in the industry tends to be one of "wait and see." Many Midwestern firms have delayed making needed decisions to replace outmoded equipment and facilities. Meanwhile, the Midwest has lost part of its previous share of markets. Whether it will lose more depends on the willingness of entrepreneurs to invest in a new system, the availability of investment funds, and the evaluation of profit opportunities in egg production versus other alternatives.

Outlet Specialization vs. Diversification

Historically, the Midwest has not only been the major surplus region for table eggs, but it has also been the center for egg breaking and drying. In recent years, breaking operations have expanded in the South and declined in the Midwest. In 1960, 92 of the 105 plants in the United States producing frozen eggs under Federal inspection were in the Midwest. By 1965, the number dropped to only 63 out of a total of 96 plants. During the same period, the number of frozen egg plants in the South rose from 7 to 23.

In addition to these plants, a substantial number of plants operate salvage breaking operations and some commercial-scale breakers are not under Federal inspection. The salvage operations use mainly cracks, checks, and smaller eggs which are in surplus seasonally. Most of the larger commercial breakers, however, are under Federal inspection and account for the bulk of liquid egg production.

Table 4.--Number of plants producing frozen and dried eggs under Federal inspection, by major geographic region, 1960 and 1965

Region	Frozen eggs		Dried eggs	
	1960	1965	1960	1965
Northeast	2	2	0	0
South	7	23	1	2
Midwest	92	63	14	16
West	4	8	1	3
Total	105	96	16	21

There is a basic difference between commercial breaking operations in the Midwest and in other regions. In the Midwest, most of these plants are not connected with shell egg operations and are competing buyers. To get supplies during the heavy breaking season, egg breakers frequently bid away producers from shell egg plants. In the South, while there are separate breaking operations, the newer entrants have tended to appear as a surplus has developed, and they are not as directly competitive with shell egg operations. This tends to be a support for table egg prices rather than a seasonally disruptive force.

As the seasonality of egg production in the Midwest declined, and as the average quality of eggs produced rose, the competition between breaking and table egg outlets may have intensified. When breaking operations were more highly seasonal, they reduced the late winter and spring surplus. At that time prices varied more widely from the period of heaviest to lightest production. This tended to be reflected in a comparable swing in frozen egg prices. As the seasonality of production has declined, so has the seasonal variation in prices. Thus, with more stable frozen egg prices, year-round breaking has increased.

Prices for unclassified eggs for breaking in the Midwest now tend to be relatively stable the year round, while other shell egg prices show a greater seasonal variation. In the months of heaviest production, weighted average prices for table eggs are lower in relation to prices for breaking stock than at other periods of the year. Prices for undergrades (including cracks, checks, and dirties) for either table egg or breaking outlets follow one another more closely. Prices for unclassified eggs for breaking in the South tend to follow weighted average prices for table eggs more closely at various seasons than in the Midwest.

While shell egg and egg-breaking operations have existed together in the Midwest for decades, purchases by breaking plants have been considered disruptive only recently. This can be partly attributed to the declining seasonality of output and prices. Another major factor is the changing nature of the

industry in other areas. In earlier years, the Midwest's position was secure as the final place for deficit areas to obtain eggs to fill their needs. Now, additional areas are able to furnish eggs to deficit areas, and these eggs tend to be uniform, of good quality, and available year round.

Marketing Channels

Farm-to-receiver, receiver-to-retailer, and retail store price spreads are regularly determined by ERS for 12 individual cities on both large and medium eggs, Grade A or better quality. These reports reflect the differences in marketing channels which exist in different areas of the country. Cities receiving most of their eggs from nearby producing areas, and generally having more direct systems of marketing to retail stores, tend to have narrower farm-to-retailer price spreads than cities receiving a large proportion of their eggs from distant producing areas and having more complex marketing systems. These more complex systems usually involve two or more wholesale firms in the assembly and distribution of eggs from farms to retail stores.

Farm-to-retailer price spreads thus reflect the differences in costs which are associated with different marketing systems. Spreads for Midwestern cities are wider than in many other areas. For example, farm-to-retailer price spreads for eggs marketed in New York are narrower for eggs received from nearby, rather than Midwestern, producing areas. Similarly, farm-to-retailer price spreads in cities such as Atlanta, St. Louis, San Francisco, and Los Angeles, which have substantial supplies of eggs nearby, are lower than in cities such as Washington, D.C., Baltimore, Seattle, and Denver. Despite the large volume of eggs produced in the Midwest, farm-to-retailer price spreads in such cities as Chicago and Cleveland are relatively wide, probably because the marketing systems serving those cities are relatively complex. In recent years, farm-to-retailer price spreads for Grade A eggs or better in Atlanta and Los Angeles and for nearby eggs at New York have been 10-11 cents per dozen compared with 16-18 cents in Cleveland and Chicago (table 5).

Small Flocks

The problem of numerous small flocks is not entirely a Midwestern phenomenon. However, in 1959, 80-90 percent of the birds in the Lake States, Corn Belt, and Northern Plains States were in flocks of less than 1,600 birds. This was higher than for any other group of States (table 6).

Preliminary figures from the 1964 Census of Agriculture indicated that the total number of farms selling eggs declined 51 percent between 1959 and 1964. Undoubtedly most of this decline resulted from the decrease in farms with small flocks. However, the problems of small flocks, while reduced, have not yet been eliminated.

Table 5.--Large eggs, Grade A or better: Major price spreads per dozen in selected cities, 1960-65

Price spread and year	Cleveland	Chicago	New York			Los Angeles	Atlanta
			Nearby	Midwest	Average		
	Cents						
Farm-to-retail:							
1960	26.7	23.2	20.2	30.6	25.9	20.7	22.8
1961	27.4	25.5	21.2	32.0	27.6	20.6	21.3
1962	26.7	25.9	23.8	32.6	28.2	19.4	20.7
1963	26.7	24.7	23.5	30.9	26.1	19.7	20.6
1964	26.3	25.1	24.2	31.8	26.1	20.6	21.3
1965	26.8	26.4	23.9	32.0	26.4	19.9	21.8
Retail store:							
1960	8.9	4.0	----	----	10.3	9.3	9.8
1961	9.7	6.2	----	----	11.4	9.5	10.3
1962	9.0	6.5	----	----	12.6	8.5	9.8
1963	9.9	5.7	----	----	13.1	8.8	9.6
1964	9.8	6.9	----	----	13.9	9.6	10.7
1965	10.7	9.2	----	----	14.2	8.8	11.7
Farm-to-retailer:							
1960	17.8	19.2	9.9	20.3	15.6	11.4	13.0
1961	17.7	19.3	9.8	20.6	16.2	11.1	11.0
1962	17.7	19.4	11.2	20.0	15.6	10.9	10.9
1963	16.8	19.0	10.4	17.8	13.0	10.9	11.0
1964	16.5	18.2	10.3	17.9	12.2	11.0	10.6
1965	16.1	17.2	9.7	17.8	12.2	11.1	10.1

When final figures from the 1964 Census of Agriculture are published, they are likely to show that the Midwest still has relatively more small flocks than many other regions. For example, data available for Iowa for 1958-64 indicate that the number of farms with layers has declined 45 percent, and that the number of hens and pullets has declined only 30 percent (32). Thus, average flock size has increased in this area. Nevertheless, less than 1 percent of the flocks in 1964 had 1,600 layers or more, and these accounted for less than 10 percent of total numbers of hens and pullets. Over 80 percent of the farms in Iowa had flocks of less than 400 layers; such flocks accounted for over half the total number of layers in the area. Even though average flock size increased from 1958 to 1964, small flocks still predominated (tables 7-8).

In the adjacent State of Illinois, a 1962 survey (31) showed that 95 percent of the farms had flocks under 400 birds. Such flocks accounted for over 60 percent of total numbers of hens and pullets of laying age. In contrast, only 0.5 percent of the farms had flocks of 2,000 birds or more, accounting for less than 14 percent of the total.

Table 6.--Chickens on hand by size of flock, 10 farm production regions and the United States, 1959

Area	Percentage distribution of chickens by flock sizes				
	Under 400	400-1,599	1,600-3,199	3,200-9,999	10,000 and over
	Percent				
Northeast	12.0	20.2	18.0	34.5	15.3
Appalachian	49.0	15.2	12.3	15.0	8.5
Southeast	20.6	10.2	15.0	29.7	24.5
Delta States	38.0	9.7	13.0	23.0	16.3
Lake States	51.2	34.3	6.7	6.3	1.5
Corn Belt	54.7	28.4	6.7	6.2	4.0
Northern Plains	69.1	25.0	3.2	2.2	0.5
Southern Plains	42.4	16.3	11.0	16.1	14.2
Mountain	40.7	14.5	10.2	19.3	15.3
Pacific	5.2	7.8	12.8	38.3	35.9
United States	37.5	20.5	10.9	18.7	12.4

As in Iowa, flock sizes have been increasing in other States. In Pennsylvania, a 1957 survey (58) showed 74 percent of the farms had flocks of less than 400 birds, but such flocks contained only 21 percent of the total number of layers. By 1963, only 23 percent of the flocks had 330 layers or less, and only 15 percent of the total number.

In other States outside the Midwest, other recent surveys also indicate the predominance of larger flocks than in the Midwest (26). In Florida, flock numbers declined from 1959 to 1964. By 1964, only 8 percent of the layers were in flocks of under 400 birds, while 52 percent were in flocks of 20,000 or over.

A New Hampshire survey in 1964 (50) indicated that 19 percent of 238 market egg flocks had under 1,000 birds and accounted for only 1.5 percent of the total number of layers. In contrast, 15 flocks had 10,000 birds or more and accounted for almost 55 percent of the total.

Table 7.--Number of farms with hens and pullets of laying age, and percentage of total number by size of flocks, Iowa, 1958-64 1/

Year	Farms reporting layers	Distribution of farms by size of flock					Total
		Under 400 layers	400-599 layers	600-799 layers	800-1,599 layers	1,600 or more layers	
	Number	Percent					
1958	119,390	91.5	6.1	1.4	0.9	0.1	100.0
1959	112,358	89.7	7.3	1.7	1.1	.2	100.0
1960	99,916	88.0	8.1	2.0	1.5	.4	100.0
1961	93,683	86.8	8.7	2.4	1.7	.4	100.0
1962	85,940	85.5	9.5	2.6	1.9	.5	100.0
1963	74,073	85.1	9.5	2.7	2.2	.5	100.0
1964	65,568	83.8	10.1	2.9	2.5	.7	100.0

1/ Based on assessor's annual farm census, at time of enumeration in Jan.-Mar. of each year.

Source: Number and Size of Farms. Geographic Patterns in Iowa (32, p. 20).

Table 8.--Number of hens and pullets of laying age, and percentage of total number by size of flocks, Iowa, 1958-64 1/

Year	Total hens and pullets	Distribution of hens and pullets by size of flock					Total
		Under 400 layers	400-599 layers	600-799 layers	800-1,599 layers	1,600 or more layers	
	Thousands	Percent					
1958	22,863	74.9	14.3	4.7	4.4	1.7	100.0
1959	23,360	70.7	15.9	5.2	5.3	2.9	100.0
1960	21,581	65.3	17.0	6.2	7.0	4.5	100.0
1961	20,843	61.8	17.7	6.9	7.9	5.7	100.0
1962	19,952	59.6	18.5	7.3	8.4	6.2	100.0
1963	17,330	57.1	18.6	7.5	9.4	7.4	100.0
1964	16,035	53.7	18.9	7.7	10.5	9.2	100.0

1/ Based on assessor's annual farm census, at time of enumeration in Jan.-Mar. of each year.

Source: Number and Size of Farms. Geographic Patterns in Iowa (32, p. 21).

A 1964 survey in Georgia indicated that of 1,544 flocks, 29.6 percent had 500-1,000 birds; 14.0 percent, 1,001-3,000; 34.1 percent, 3,001-10,000; 15.8 percent, 10,001-25,000; 4.3 percent, 25,001-50,000; and 2.2 percent, over 50,000 (25).

Small flocks are a problem because many more lots of eggs are handled and many more individual orders of chicks and feed are delivered than with large flocks. Also truck travel time is increased if they are widely scattered. The result is more expensive egg assembly and feed and chick distribution operations. Other problems are higher packing plant costs and lower average egg quality.

The existence of small flocks may delay the adoption of automatic grading systems in egg-packing plants because of the time which would be lost daily between lots. For example, assume that an egg-packing line is set to run 60 cases per hour, and it takes 1.5 minutes to change over from one lot to another. If lot sizes average 1 case each, 288 minutes will be lost daily and the plant can only average 24 cases per hour. With lot size averaging 5 cases, 110.8 minutes would be lost daily and 46.2 cases per hour handled. With 10-case lots the respective figures would be 62.6 minutes lost and 52.2 cases per hour; with 30-case lots, 22.8 minutes and 57.15 cases per hour; and with 60-case lots, 11.7 minutes and 58.5 cases.

Egg Quality

A study of the records of 800 producers for a year indicated that egg quality, on the average, was substantially lower for flocks delivering less than 3.6 cases per week. Lots from these flocks averaged only 57 percent Grade A. For lots of 3.6 to 9.6 cases per week, the eggs averaged 85 percent Grade A, and at 9.6 cases and above per week, 90 percent were Grade A eggs. There were substantial individual variations above and below these averages. Quality is a result of many things in addition to flock size, such as the quality of chicks and feed and practices, and how well quality-control specifications are followed.

These data were collected in 1960-62 from 10 plants in 3 different regions--the Northeast, Midwest, and South. Plants in the Northeast had a higher average percentage of Grade A eggs delivered to them by producers than plants in the other areas. Plants in the Northeast averaged 93 percent Grade A's, the Southeast 88 percent, and the Midwest 85 percent. A greater variation existed among plants in the Midwest than among plants in other areas. The best plant in the Midwestern sample averaged 89 percent Grade A's compared with 77 percent for the poorest plant.

Lower average annual percentages of Grade A eggs delivered by producers are associated with both smaller flocks and with larger declines in average egg quality during the summer and late fall and winter. Producers tend to maintain their ranking as producers of either high-quality or low-quality eggs throughout the year.

These data suggest that larger flocks, better holding and handling practices, and strict enforcement of quality-control programs can improve average egg quality. Such practices have worked in the Midwest, as well as in other areas. However, average quality received at Midwestern plants still seems to be lagging behind that in some other areas.

Costs of Assembling and Packing Eggs

The basic relationships between costs of various sizes of egg packing plants, and the costs of assembling eggs have been the subject of several studies in the last few years. Some of these studies are summarized below to provide a basis for evaluating the relative position of the Midwest in these primary marketing functions.

Bird (8) developed six synthetic model plants based on hand-candling operations. The models had the following capacities per hour of operation: Model A, 6 cases; Model B, 12 cases; Model C, 24 cases; Model D, 36 cases; Model E, 48 cases; and Model F, 96 cases. When these plants were assumed to operate for 260 8-hour days per year, and to use eggs averaging 75 percent Grade A or better, the average total costs per case were as follows: Model A, $2.14; Model B, $1.88; Model C, $1.71; Model D, $1.63; Model E, $1.59; and Model F, $1.50. Costs declined with 2- and 3-shift operations. Costs in single-shift operations were also lower when eggs averaged 90 percent Grade A rather than 75 percent.

Peeler and King (57) developed five synthetic model plants based on automatic washing, grading, and packing and flash candling, and with provision for breaking 10 percent of the daily volume and packing 10 percent loose and 80 percent cartoned eggs. Capacities for the five models, at 90 percent of machine-rated capacity, were: Model I, 18 cases per hour; Model II, 36 cases per hour; Model III, 72 cases per hour; Model IV, 144 cases per hour; and Model V, 288 cases per hour. When these model plants were assumed to operate 250 8-hour days per year, the average total costs per case were: Model I, $2.52; Model II, $2.21; Model III, $2.08; Model IV, $1.99; and Model V, $1.95. Costs declined for double-shift operations despite the assumption of higher wage rates for the second shift.

Jones developed seven synthetic model plants based on semiautomatic grading machinery, with automatic sizing and automatic packaging equipment (35). Operating capacities for the models, in cases per operating hour, were: Model A, 7; Model B, 12; Model C, 18; Model D, 36; Model E, 52; Model F, 80; and Model G, 120. When these plants were assumed to operate for 260 8-hour days per year, to pack 90 percent in cartons and 10 percent in cases, and eggs were 90 percent Grade A or better, the average total costs per case were: Model A, $1.93; Model B, $1.75; Model C, $1.71; Model D, $1.57; Model E, $1.52; Model F, $1.49; and Model G, $1.45. Costs were lower with double-shift than single-shift operations. Costs in single-shift operations increased as the percentage of Grade A eggs declined below 90 percent.

In another study, Jones projected egg grading and packing costs under changing cost and technological conditions (37). His findings showed that egg grading and packing plants in 1970 will be operating at very nearly the same overall level of costs per unit as they are at present, but that costs may be somewhat higher by 1975. The relationships between costs of firms of various sizes may change somewhat, economies of scale becoming a more important factor than in the past.

Economies of scale studies necessarily involve standardization of factor prices such as wage rates. In practice, factor prices vary from one area to another. Thus, while the technical efficiencies are equally available to firms in all areas, the actual costs per unit of output may vary because of differences in factor prices. But, in many instances, factor prices at country points do not differ enough from one region to another to yield significant differences in costs. The notable exceptions are comparisons between plants in metropolitan areas and those at country points, and the wage and salary levels on the West Coast in comparison with those in the Midwest and the South. During the past decade, many candling and cartoning plants in cities have closed. Country plants now perform most of these operations.

Conlogue demonstrated the potential savings if country-point candling and cartoning were done in the Midwest rather than in large metropolitan areas (20). Savings averaged 6 cents per dozen when eggs went directly from plants to retailers. Main sources of the savings were: Elimination of one candling operation; reductions in transportation and egg replacement costs when undergrade eggs are kept out of shipments; and elimination of overhead and general expenses of one marketing firm. Savings would be reduced 2 to 2.5 cents per dozen if a distributive agency were necessary. The production of high-quality eggs would be necessary to secure the savings from country-point candling and cartoning.

On the basis of economies of scale studies alone, it appears that a smaller number of plants of the largest size would represent the optimum (least-cost) solution for the packing function. However, the costs of assembling eggs must also be taken into account. Assembly costs are related to the density of egg production in the area around the plant. The higher the density, the larger the plant size which the combined assembly and plant costs will indicate at optimum. The larger the optimum plant size, the lower the combined costs.

Even if the density of production in two areas is comparable, an area with fewer and larger flocks offers the potential of lower assembly and packing costs than an area with more and smaller flocks. This is because there are more stops to make in picking up eggs and more lots to handle at the plant.

Conlogue studied costs of assembling eggs in three Midwestern States (19). Total assembly costs per case for 20 routes averaged 39 cents per case, with a range of 20 to 59 cents. Labor cost per case averaged 20 cents, with a range of 10 to 31 cents. Truck costs averaged 19 cents per case with a range of 6 to 36 cents. High numbers of cases per stop, per mile, and per hour were associated with lowest cost routes. Twenty-three percent of the farms provided only 5 percent of the volume. Savings of 15 to 45 percent were estimated based on realignment of routes, use of set-in stations, payment of price differentials based on volume, and elimination of pickups from very small flocks.

Peeler and King studied the optimum locations for egg packing plants in North Carolina (56), taking into account the present location of production, assembly costs, and plant costs. Total combined assembly and processing costs were minimized with six double-shift plants. Volumes for these plants varied, depending on production density in the surrounding areas. Combined costs of assembling and packing North Carolina's commercial egg production could be significantly reduced by movement toward the optimal six plants.

Sanders and Fletcher (68) used a 13-county area in central Iowa to study the optimum marketing organization which would minimize combined assembly and processing costs. They considered (1) automatic and semiautomatic plant equipment, (2) scale of processing plants, (3) single- and double-shift operations, (4) 80 percent cartoned and 20 percent case-packed versus 70 percent and 30 percent case-packed, (5) truck sizes from 100 to 250 cases, (6) once-per-week versus twice-per-week assembly, (7) flock sizes ranging from present pattern to an average size of 20,000 layers per flock, (8) various locations for processing plants, and (9) changes in production density. The least-cost solution with the existing production pattern, 80 percent cartoned, and once-per-week pickup, was one double-shift plant having an annual volume of 1,331,512 cases. With semiautomatic equipment average cost per case for assembling and processing was $2.21 per case; with automatic equipment, $2.13 per case. Optimum solutions with all flocks of like size were: 1,000-bird flocks, $1.996; 5,000 birds, $1.968; and 20,000 birds, $1.965. With pickups twice a week and the present production pattern, costs were about 10 cents per case higher than with pickups once per week. Fewer and larger plants, larger trucks, automated equipment, multiple-shift plant operations, and increased density were all cost-reducing factors in their analysis.

The optimum solution in locational studies typically indicates single plants serving given areas. In practice, few plants have an exclusive supply area throughout the territory in which they operate. Rather, two or more plants are likely to buy in most areas. From a purely efficiency standpoint, exclusive supply areas are indicated. However, unless producers are able to bargain effectively, or unless exclusive supply areas permit plants to pass back savings by paying top prices, the bargaining position of producers could be adversely affected by the optimum solutions. This dimension has not been explored in many empirical studies.

Data on egg handlers for 1958 are shown in table 9. No comprehensive national surveys of egg handlers have been made since then. The East North Central and West North Central States had a larger proportion of the total number of handlers than they did of total egg production. The reverse was true for the New England, Middle Atlantic, South Atlantic, and Pacific Coast States. There is little in the limited information available for later years to suggest that the Midwest had overcome its earlier disadvantages regarding smaller average plant sizes and lower production density (table 10). In 1965 the East and West North Central Regions had larger shares of the firms in the sample than of the volume covered.

Table 9.--Distribution of egg handlers, and eggs sold off farms, by regions, 1958

Region	Firms receiving eggs from farmers		Annual average volume per firm	Eggs sold from farms	
	Firms	Percent	Cases	1,000 cases	Percent
New England	104	0.8	36,596	7,675	5.0
Middle Atlantic	508	3.9	33,142	20,856	13.5
East North Central	5,270	40.9	4,961	30,628	19.9
West North Central	3,925	30.4	11,706	42,267	27.4
South Atlantic	577	4.5	15,827	14,867	9.6
East South Central	274	2.1	11,770	7,345	4.8
West South Central	650	5.0	9,583	9,452	6.1
Mountain	444	3.4	6,320	3,640	2.4
Pacific	1,158	9.0	12,307	17,438	11.3
United States	12,910	100.0	9,944	154,167	100.0

Source: Faber and Pedersen (23).

Table 10.--Distribution of firms and of volume by regions, and number and size of firms in a sample of egg handlers, 1963 and 1965 1/

Item	1963		1965	
	Percent of firms	Percent of volume	Percent of firms	Percent of volume
North Atlantic	16.2	16.7	17.0	16.8
East North Central	17.0	15.3	18.0	15.9
West North Central	31.5	25.4	25.2	17.6
South Atlantic	14.3	12.6	16.4	16.4
South Central	10.8	9.8	12.2	13.3
Western	10.2	20.0	11.2	20.0
United States	100.0	100.0	100.0	100.0

	1963	1965
Number of firms	795	689
Average volume of eggs handled per week (cases)	1,383,346	1,325,100

1/ Firms reporting to USDA Market News Service in connection with Commercial Egg Movement Report. 5-week average, mostly mid-April to mid-May 1963, and 5-week average, mostly March to early April 1965.

The density of egg production in the Midwest is lower than in most other major producing regions. Two rough measures of production density are presented in table 11. In these comparisons, the East and West North Central States rank well below the New England, Middle Atlantic, South Atlantic, and Pacific Coast States.

With more small plants, and production more widely scattered, the primary marketing system in the Midwest is likely to be operating at higher costs than that in many other areas.

Factor Prices and Input-Supplying Systems

Among the major inputs for egg production are feed, chicks, and labor. Feed costs make up 50-70 percent of the total cost of producing eggs, chick (or replacement) cost, 20-25 percent; and labor and management cost 5-10 percent.

Farm wage rates are important in appraising a region's competitive position in egg production. First, they provide some indication of the region's labor cost in egg production. Second, the farm wage rate is useful in providing some measure of the alternatives open to farmers and farm labor in one region compared with another. If alternatives are few, farmers and farmworkers may accept relatively low returns. This could mean that even though a region may not have an absolute advantage in egg production, its inhabitants may produce eggs, while people in other areas with a greater absolute advantage in eggs, but more favorably situated in alternative employment opportunities, either on or off the farm, may shift out of egg production.

Farm wage rates throughout the country have been rising steadily since the late 1940's. From 1959 to 1965, rates per hour for workers not receiving room and board increased over 3 percent a year, from $0.92 in 1957-59 to $1.14 in 1965. Farm wage rates during this entire period were substantially higher in the North than in the South, and higher on the Atlantic and Pacific Coasts than in the central part of the country. Wage rates increased most in the South Atlantic and South Central States and least in the New England, Middle Atlantic, East North Central, and West North Central States. Overall, however, there was little change in the absolute differences in wage rates among regions from 1959 to 1965 (table 12). If legislation is passed to extend minimum wage coverage to agricultural workers, this will create greater uniformity among regional farm wage rates. Such a development, as well as a climb in wage rates in the South at a faster rate than those in the Midwest, could be advantageous to the Midwest.

Prices in the Midwest for major poultry feed ingredients, such as corn and soybean meal, average about the same as the U.S. average or below it. The same relationship holds for the "poultry ration," based on prices of these and other ingredients weighted together in a standard formula. Prices received by farmers for corn in the East North Central and West North Central Regions in 1960-64 and 1965 were slightly below the U.S. average, while corn prices in all other regions were somewhat above the U.S. average. On soybean meal, prices paid by farmers were somewhat below the U.S. average in 1960-64 and 1965 in the

Table 11.--Density of egg production, by regions, 1963

Region	1959		Chicken eggs sold, 1963	Chicken eggs sold--	
	Farms	Cropland		Per acre of farmland	Per acre of cropland
	Mil. acres	Mil. acres	Mil. doz.	Doz.	Doz.
New England	9.3	3.3	230.2	24.68	70.26
Middle Atlantic	26.8	14.8	551.5	20.59	37.23
East North Central	103.4	72.6	779.6	7.54	10.74
West North Central	282.0	166.8	990.0	3.51	5.94
South Atlantic	83.3	30.1	775.0	9.31	25.74
East South Central	68.3	31.8	429.1	6.28	13.50
West South Central	205.8	63.7	415.7	2.02	6.53
Mountain	264.2	41.2	107.8	.41	2.62
Pacific	80.1	26.7	744.9	9.30	27.87

Table 12.--Farm wage rates per hour without room and board, by regions, 1948, 1957-59, and 1965

Region	Rate per hour			Percentage change
	1948	1957-59	1965	1957-59 to 1965
	Dollars			Percent
North Atlantic	0.88	1.10	1.30	+18
East North Central	.84	1.06	1.21	+14
West North Central	.88	1.05	1.22	+16
South Atlantic	.53	.69	.87	+26
South Central	.54	.67	.86	+28
Western	.92	1.08	1.32	+22
United States	.73	.92	1.14	+24

East South Central and West South Central Regions, slightly below in the West North Central Region, and only slightly above in the East North Central Region. Prices in all other regions were still further above the U.S. average than those in the East North Central Region. Prices paid for the "poultry ration" were furthest below the U.S. average in the West North Central Region. Prices in the East North Central and West South Central Regions were also below the U.S. average (table 13). These comparisons tend to support the assertion that the Midwest has an inherent competitive advantage in lower feed prices.

However, if prices paid by farmers in individual regions for such finished items as layer feed and scratch grain are compared with U.S. averages, a different picture emerges. In these comparisons, average prices in the East North Central and West North Central Regions are at and above the U.S. average. On layer feeds, prices in regions such as New England, Middle Atlantic, West South Central, and Pacific are no higher, and are sometimes lower, than in the Midwestern regions. On scratch grain, prices in almost all regions are lower than in the Midwest. Even if allowance is made for sample variations, differences in ration composition, and sizes of purchases, it may be that the Midwestern feed industry is less efficient than it could be. On the basis of lower costs for major ingredients, it seems that finished feed prices should be lower than in most other regions. On the basis of available price series, finished feed prices are not conclusively lower (table 13).

With respect to prices paid by farmers for baby chicks, averages for 1960-64 and 1965 showed prices in the Midwest to be somewhat above those for the United States as a whole. On the other hand, prices in the New England, East South Central, and Pacific Regions were well below the U.S. average in both periods. In 1965, prices in the South Atlantic Region were just under the U.S. average while those in the Middle Atlantic Region were just over the U.S. average. These data suggest that the Midwest may be at a disadvantage on baby chick prices as well as feed prices in comparison with several other important egg-producing regions (table 14).

Milling and feed distribution costs are related to the efficiency of the feed industry in an area. Density and size of producing units are important in determining costs of distributing feed. As with egg assembly and packing, combined milling and distributing costs are minimized where a high density of production exists. The density of egg production in the Midwest is low in relationship to other areas, although it is possible the effects of this on costs of distributing feed are partly offset by feed furnished for other livestock.

As with any pickup or delivery operation, small lots are more expensive per unit to handle. This is due to recordkeeping and billing operations and because the time involved in preparing to unload a small lot is as great as for a larger lot.

Where firms are selling feed to unaffiliated producers, costs of advertising and selling have historically been large in relation to actual milling and mixing costs. Where coordinated production, input-supplying, and marketing complexes exist, these costs can be largely eliminated.

Table 13.--Prices per 100 pounds of major poultry feed ingredients and mixed feeds for laying flocks, by regions, 1960-64 and 1965

Item and year	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	United States
					Dollars					
Corn 1/:										
1960-64	2.76	2.35	1.90	1.87	2.24	2.12	2.13	2.40	2.47	1.93
1965	2.86	2.43	1.93	1.93	2.23	2.23	2.25	2.45	2.55	1.96
Soybean meal, 44% 2/:										
1960-64	4.80	4.73	4.59	4.41	4.70	4.34	4.24	4.97	5.36	4.58
1965	5.13	5.06	4.97	4.74	5.06	4.69	4.66	5.28	5.73	4.93
Poultry ration 2/:										
1960-64	4.02	3.64	3.22	2.87	3.87	3.43	3.35	3.47	3.73	3.42
1965	3.86	3.63	3.31	2.94	3.90	3.53	3.36	3.28	3.33	3.43
Layer feed 2/:										
1960-64	3.97	4.30	4.38	4.31	4.67	4.53	4.26	4.52	4.33	4.38
1965	3.99	4.39	4.54	4.46	4.74	4.60	4.31	4.56	3.88	4.41
Scratch grain 2/:										
1960-64	3.95	3.81	3.88	3.88	4.02	3.89	3.62	3.70	4.16	3.88
1965	3.89	3.80	4.06	4.01	4.07	3.96	3.74	3.63	3.88	3.92

1/ Prices for bushel received by farmers, converted to price per 100 lbs.
2/ Prices paid by farmers.

Table 14.--Prices paid by farmers for 100 hybrid and crossbred pullet baby chicks, by regions, 1960-64 and 1965

Region	Prices paid in--	
	1960-64	1965
	Dollars	Dollars
New England	1/42.60	42.00
Middle Atlantic	48.40	49.10
East North Central	52.60	52.30
West North Central	51.40	51.70
South Atlantic	52.80	47.80
East South Central	47.20	41.30
West South Central	50.50	52.70
Mountain	49.20	44.40
Pacific	43.80	37.10
United States	49.90	48.50

1/ 1961-64.

Some of the same reasoning which applies to costs of milling and distributing feed applies equally well to hatching and distributing chicks. Economies of scale exist in both milling and hatching, and production density and flock size are important determinants of costs of distributing those items. Some of the possibilities for cost reduction through increased mill or hatchery size and increased density of the supply area can be shown by the following recent studies.

Costs of hatching egg-type chicks were developed by Pedersen (54) for six model hatcheries with annual capacities (year-round operation) of 1, 2, 3, 4, 7, and 10 million eggs. With salable pullets representing about 40 percent of all eggs set, costs at 100 percent of capacity decreased from 5.90 cents per salable pullet chick in the smallest model to 4.79 in the largest. With only a 22-week hatching season (present average practice), costs at 100 percent of capacity for the same model sizes ranged from 8.64 to 6.72 cents.

A study at New Hampshire demonstrated the existence of economies of scale in feedmilling (12). A mill, operating at capacity, and capable of producing 21 tons of broiler feed per day, including pelleting, could operate for $8.59 per ton. A mill with a capacity of 125 tons per day could operate for $5.23 per ton, while a 350-ton-per-day mill would have costs of $4.00 per ton. It is again probable that similar economies of scale exist in producing feed for egg production, and that per-ton costs would be substantially lower without the pelleting operation.

Studies made at New Hampshire on costs of distributing broiler chicks and broiler feed (13) can furnish some further indications of the effects of production density. Where broiler production density was 1,000 pounds per square mile, and 35 million pounds of live broilers were supplied annually, the cost per pound of live broiler for distributing chicks was 0.07 cent and the cost of distributing feed 0.77 cent. When production density was increased to 25,000 pounds per square mile, the cost per pound of live broiler for distributing chicks fell to 0.03 cent and the cost of distributing feed fell to 0.28 cent, declines of almost 60 percent.

Costs of Egg Production

The rate of egg production per layer is an important statistical indicator of the relative position of various regions. Changes in the rate of lay influence the cost of producing eggs and indicate in a rough way the quality of laying flock management. Production has become more efficient throughout the country as a result of improvements in feeds, production practices, and disease-control measures. However, based on increases in the rate of lay alone, it seems apparent that the South Central States and the South Atlantic States have reduced production costs and upgraded laying flock management more than other regions in the last 7 years. Therefore, during this period they have improved their competitive positions. However, since these two regions now have about caught up with the rest of the country in eggs per layer, their rate of improvement in the future may more closely parallel the average rate of gain for the Nation as a whole.

Egg production per layer in the United States increased 7 percent, to 218 eggs per layer, in the 7 years through 1965. From 1945 to 1955, it increased about 2 percent per year. Areas with a relatively low rate of lay in the early 1950's have shown the most improvement. As a result, differences in the rate of lay by regions narrowed considerably after the war and especially since 1957-59. Over the last 7 years, eggs per layer increased 10 percent in the South Central States and South Atlantic States, where output per layer has been below the U.S. average, but only 3 percent in the West, where layer productivity continues to be highest. In 1957-59 the rate of lay averaged 10 percent below the U.S. rate in the South Central States and 8 percent above it in the West. By 1965 the South Atlantic Region's annual rate was only 3 percent below average at 210 eggs per layer, and the West's rate was 4 percent above average at 226 eggs. All the other regions in 1965 had rates of lay within 1 percentage point of the national average (table 15).

Planting (59) summarized data on costs of producing eggs in various States from 1955 to 1961. Costs ranged from 25 to 43 cents per dozen, but mostly from 28 to 32 cents per dozen, excluding operator's labor and interest on investment. In the Northern States, costs tended to average 1-2 cents per dozen higher than in the South and Southwest, probably because of the colder climate which increases feed requirements and contributes to higher expenses for light, heat, and buildings, and the greater importance of heavy breeds in the Northeast.

Table 15.--Eggs produced per layer, by regions, averages 1947-49 and 1957-59, and annual 1965

Region	Eggs per layer			Percentage change, 1957-59 to 1965
	1947-49	1957-59	1965	
North Atlantic	185.0	205.9	216.6	+5
East North Central	173.7	206.1	219.0	+6
West North Central	170.0	205.4	219.6	+7
South Atlantic	148.3	197.2	216.9	+10
South Central	140.9	181.7	210.1	+10
Western	177.2	220.1	225.9	+3
United States	166.3	202.9	217.7	+7

In the same study, costs were estimated for each State on the basis of uniform standards of performance. Major standards used were 4.75 pounds of feed per dozen eggs; 11 percent laying flock mortality; 224 eggs per bird per year; 14 months' laying period; 1.5 cents per dozen for miscellaneous costs; 1.6 cents per dozen for average building and equipment depreciation, adjusted for regional differences; and $1.60 per head for replacement pullet cost, adjusted for regional differences. Standardized costs in the North Atlantic States ranged from 27 to 28 cents a dozen compared with 26-28 cents in the Southern States from the Carolinas westward to Texas and Oklahoma. In the Corn Belt and Plains States, where large quantities of locally produced grain are available, costs averaged 23-26 cents a dozen. In the Southwest and Pacific Coast States, standardized costs ranged from 27 to 31 cents a dozen. While costs were admitted to vary with flock size, such differences were not built into standardized estimates. Partial information indicated costs per dozen eggs in large flocks (over 20,000 layers) may average 3-5 cents per dozen below costs in less efficient small farm flocks (59).

Net returns from egg production (for operator's labor and interest on investment) ranged from 2.5 to 12.0 cents per dozen and averaged 7.3 cents for studies reported for 1955-61. When net returns were calculated using standardized costs and average prices received for market eggs during 1959-61, net income averaged 5.6 cents per dozen. Net income ranged from 13 cents in the New England States to 3 cents in the Western Corn Belt States, but mostly it was between 4 and 10 cents. Many Corn Belt flocks were kept as a sideline, and overhead costs were paid in part by other enterprises. Hence, producers probably obtained satisfactory net incomes from farm flocks. However, incomes of full-time specialized flocks were under pressure because of low egg prices received in the Corn Belt (59).

Carncross assembled data on costs of producing eggs in various States during 1957-59 (15). Exact comparisons were difficult to make because of methods, flock sizes, and samples. Costs, including labor, were 29 cents per dozen for Iowa and Minnesota and 30 cents in Indiana. In North Carolina, with larger flocks, costs averaged 28 cents per dozen; they averaged 32 cents in New York, and 41 cents in New Jersey.

Niles and Williams assembled a portfolio of cost studies for pullet growing and laying flock units made since 1958. Egg production cost and numbers of layers were as follows: Maryland, 1,200 layers, 28.1 cents per dozen eggs; California, 3,000 with 3 layers per cage, 28.6 cents; California, 4,000 with 4 layers per cage, 29.7 cents; New York, 2,100 layers, 41.7 cents; New York, 7,900 layers, 36.7 cents. For high-density housing and 10,100 layers, costs per dozen eggs in New York were 42.2 cents. In conventional types of layer housing, fully allocated costs per dozen eggs and numbers of layers were as follows: Indiana, under 250 layers, 57 cents; Indiana, 1,000-1,500 layers, 39 cents; Ohio, 2,000 layers, 33.6; Pennsylvania, 3,900 layers, 37.3 cents; Midwest, unspecified number of layers, 28.1 cents; New York, 4,700 layers, 42.3 cents; New York, 11,600 layers, 40.3 cents; California, 10,000 layers, 28.6 cents; California, 20,000 layers, 29.7 cents; and Arkansas, 100,000 layers, 25.8 cents (53).

Lack of comparability in treatment of cost items, as well as differences in flock sizes, time periods, and types of housing, detract from the value of comparisons between studies. One way to remove some of these disadvantages is to have studies or estimates prepared uniformly at one point in time. At a recent meeting (33), Johnson, Bell, Cox, and Hefler presented estimated costs of producing market eggs in the major regions of the country, for large commercial flocks of about 20,000 layers or above. Costs in the East were estimated at 31.7 cents per dozen, in the Midwest at 28.1 cents, in the South at 28.0 cents, and in the West at 25.8 cents. The flocks in the West (California), that were used as a basis for estimating, tended to average somewhat larger than in other areas (table 16). These estimates show that, despite some differences in prices of inputs, costs for flocks of comparable size may be relatively close for different regions.

Another way of eliminating variation from cost comparisons is to use a budgetary or synthetic method to develop costs for flocks of one or more sizes under specified conditions.

A Kansas study (41) estimated costs for "superior" and "good" flocks of 2,600 layers at 1959-60 price levels. Annual egg production per layer was 264 eggs for the superior flock and 231 eggs for the good flock. Mortality rates were 5 and 12 percent, respectively. Annual net returns per hour of labor were $0.85 and $0.35, respectively, or 3.89 and 1.82 cents per dozen. Costs totaled 26.3 cents per dozen for the superior flock and 28.9 cents for the good flock.

A study at Oklahoma projected costs for several production methods and five laying flock sizes, 1,500, 3,000, 6,000, and 12,000 layers (21). With operator's annual labor at $2,500, additional hired labor at $0.75 per hour,

Table 16.--Estimated costs per dozen for producing eggs in major regions, by specified items, 1965

Item	East	Midwest	South	West
	- - - - - - - - - - Cents - - - - - - - - - -			
Feed	16.50	14.50	14.51	14.7
Hen depreciation	8.10	8.58	7.10	6.0
Building & equipment depreciation	2.70	1.68	1.11	1.0
Labor	2.50	1.62	2.63	2.0
Utilities	.50	.59	.32	.2
Interest	.50	.79	.62	.5
Insurance & taxes	.15	.24	.21	.2
Medication & vaccination	.25	.11	.26	.2
Litter	0	0	.21	0
Miscellaneous	.50	.43	1.00	1.0
Total	31.70	28.09	27.97	25.8

Source: Egg Cost Clinic (33).

and assuming a zero return to management, lowest costs per dozen were: 1,500-layer flock, 36.1 cents; 3,000-layer flock, 31.7 cents; 6,000-layer flock, 28.2 cents; and 12,000-layer flock, 28.5 cents.

A North Carolina study gave the following costs per dozen eggs produced, with 2.0 square feet of floor space per bird and with owner-operator labor included at $1.20 per hour: 1,500-layer flock, 31.6 cents; 2,000-layer flock, 31.2 cents; 2,500-layer flock, 30.9 cents; 3,000-layer flock, 29.9 cents; 4,000-layer flock, 29.6; 8,000-layer flock, 29.5 cents; 10,000-layer flock, 29.4 cents; and 14,000-layer flock, 29.3 cents. Total costs per dozen eggs increased as floor space per layer was increased or decreased from 2.0 square feet per bird (73).

An Illinois study found that economies of size were substantial in floor-managed egg-laying operations. These could be erased by poor management or marketing, or offset by external factors such as feed prices, and bargaining discounts on equipment. With one square foot per bird, and quantity discounts on started pullets, annual nonfeed costs per bird were: 1,000-layer flock,

$3.62; 2,500-layer flock, $3.39; 5,000-layer flock, $3.05; 10,000-layer flock, $2.62; 25,000-layer flock, $2.53; 50,000-layer flock, $2.48; and 100,000-layer flock, $2.45. Costs per bird increased as space per bird was increased. At 20 dozens of eggs per hen housed, nonfeed costs ranged from 18.1 to 12.2 cents per dozen for the 1,000 and 100,000 layer flocks (28).

These studies demonstrate the existence of economies of scale in egg production. With comparable management, then, larger flocks can produce eggs more cheaply.

In summary, the Midwest should have some inherent advantages in egg production, mainly in terms of cheaper feed. However, relatively smaller flocks in the Midwest now tend to raise costs in relation to those in other areas. Some of the reasons that production has persisted in the Midwest as strongly as it has relate to the availability of unpaid or minimum-cost family labor, and to the use of homegrown feeds and other resources without direct charge to the egg enterprise. When the time comes that such resources are no longer available and must be replaced by cash outlays, the "true costs" of egg production will be more apparent. Even under these conditions, if larger commercial flocks are developed, and the delivered price or cost of feed and chicks is reduced, the Midwest can readily hold its own with respect to costs of producing eggs.

Alternative Employment Opportunities

The gross return to the egg producer may be estimated subtracting various components from the retail price. To derive the net return to producers, cash outlays for production inputs must be considered and subtracted from the gross return the producer receives. The "effective net return" is also influenced by the value the producer places on labor, housing, and equipment. These are likely to vary with flock size. In the final analysis, the producer compares his net returns with the returns he could get in other endeavors for the same resources.

The significance of changes in farm wage rates as an indicator of alternative employment opportunities has been discussed. Similar evaluations could also be made of other factor (input) prices which are usable in various ways.

At least in the short run, there are certain resources and skills which are usable only in poultry enterprises. Some equipment and buildings are not adaptable to other uses. Individuals with training and experience in poultry production may be unable or unwilling, sometimes because of age, to learn new skills. In such situations, these resources and skills may be available for egg production at little or no cost.

In the absence of detailed studies on the profitability of many alternative employment opportunities in various regions, trends in the production of eggs can indicate how producers in a region have viewed eggs versus other alternatives. Projections which assume such trends will continue, however, are extremely hazardous, except in the very short run. In recent years, the South

Atlantic, South Central, and Western Regions have increased egg production, both in absolute and relative terms. In the East North Central, West North Central, and North Atlantic Regions, egg production has decreased. Figure 2 shows the changes in shares, by regions, of U.S. egg production by years since 1940.

FUTURE OF THE MIDWESTERN EGG INDUSTRY

The position of the Midwest as the "egg basket" of the Nation has been increasingly challenged during the last decade. Both researchers and industry spokesmen have expressed many opinions about the future of the egg industry in that region. Most of them believe that major changes are needed in the structure of the Midwestern egg industry. However, opinions differ on what these changes are, and how rapidly they will occur, and thus, on the extent to which the Midwest can hold its present position.

An aggregative view of the Midwestern egg industry obviously obscures many commendable and developing changes which individual firms are making. But individual firms cannot wholly escape from the regional environment and its price results. Hence, in the aggregate situation, there is room for further and extensive improvements. The Midwest can compete, but it will have to become more efficient to do so. It can learn from the recent developments in other areas, though it need not necessarily copy exactly these other systems.

Economists at Midwestern institutions, who have been studying the Midwestern egg industry, have made many suggestions for improving the industry. These suggestions generally involve larger and more efficient production, input-supplying, and marketing units, and a higher degree of coordination of these functions.

Ullman, in discussing South Dakota's future in the egg industry, indicated increased efficiency was necessary to lower marketing costs (78). In pointing out the disadvantages of small scattered flocks, he recommended that more large-volume production units of 5,000 birds and up be established. He also recommended concentrated and coordinated "cores" of about 150,000 layers, establishing egg-marketing agencies with a volume of 3,000 cases of high-quality eggs per week, and associated input-supplying activities.

In discussing the future of the Midwestern egg industry, Larzelere (43) indicated the Midwest had the following advantages: (1) Expanding human population; (2) ability to grow most feed ingredients in surplus quantities; (3) historical know-how in both feed and egg production and marketing; and (4) both shell egg and processed egg product segments of the industry. He believed the salvation of the industry depended on the amount and skill of synchronization of the individual segments. Leaders of industry complexes could be hatcherymen, feedmen, producers, marketing men, credit men, or others. However, they would have to develop complexes based on pockets of concentrated production instead of widely scattered production. Operations at each stage would need to become more specialized in place of the traditional diversified operations. The number of steps and agencies would need to be reduced to a

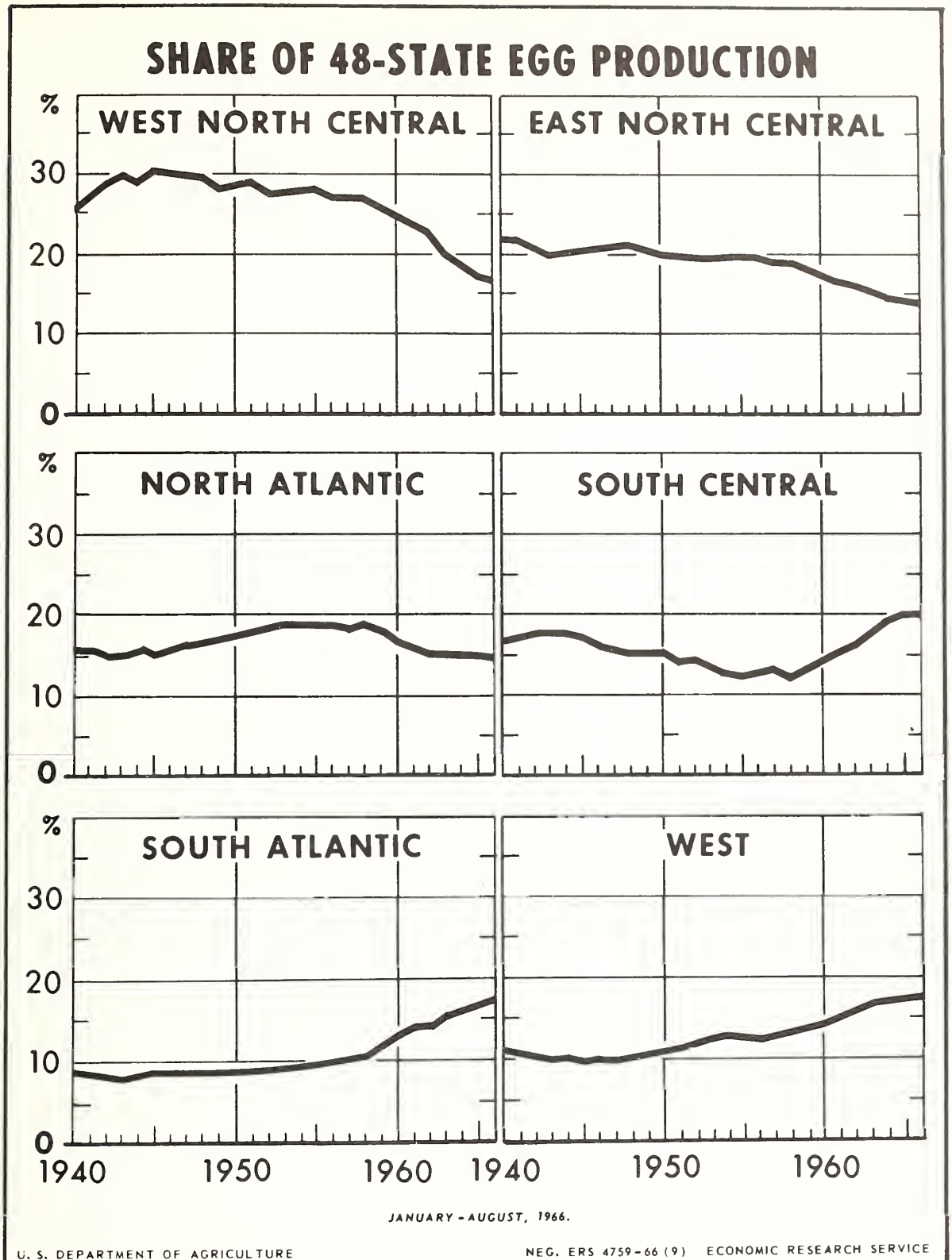
SHARE OF 48-STATE EGG PRODUCTION
%
WEST NORTH CENTRAL
EAST NORTH CENTRAL
NORTH ATLANTIC
SOUTH CENTRAL
SOUTH ATLANTIC
WEST
30
20
10
0
1940
1950
1960
JANUARY - AUGUST, 1966.
U. S. DEPARTMENT OF AGRICULTURE
NEG. ERS 4759-66 (9) ECONOMIC RESEARCH SERVICE

Figure 2

minimum, including more direct marketing. Contracts should be more widely used but they should be equitable so all units of an industry complex can work as a team. An improved price-determining arrangement is needed (for all areas). In particular, the arrangement should facilitate negotiation between coordinators of industry complexes and buyers for retail food chains or large users of processed egg products. He suggested the complex might involve the following: (1) One egg procurement, grading, and distribution unit handling about 200,000 cases a year; (2) one hatchery providing 350,000 sexed chicks a year; (3) one feed mixing and distributing unit handling about 16,000 tons of feed a year; (4) about 16 producers and 8 pullet growers; and (5) one or two financial institutions.

Recently, the North Central Regional Poultry Marketing Project, NCM-31, has been studying coordinated egg production and marketing systems in that region. Methods of coordination are changing from open market pricing to contractual relationships. Package programs, where sets of inputs are furnished to or financed for the producer, and owner-integrated programs appear to be expanding more rapidly than quality-control or contract-production programs. At the time of the study, the sample programs studies covered about 10 million birds in 11 States. More than half the layers were included in quality-control programs. Feed manufacturers or dealers were prominent in all types of programs; hatcheries and farm supply organizations were less prominent. Egg handlers or processors were important in both quality-control and package programs, and a few retailers were involved in quality-control programs. Nearly all contract production and package programs involved organizations selling feed. Most of the quality-control programs were started before 1958-59, whereas most of the contract-production and package programs were started after 1958-59 (6).

But in the Midwest, as in some other areas, a degree of bias has persisted against contract production. However, there are indications this situation is changing. Contract and independent producers in Indiana, North Dakota, and Wisconsin were surveyed in another phase of the North Central studies. Contract producers were generally satisfied with this method of organizing egg production and marketing activities. Stabilized income, financing, guaranteed markets, supervision, and management assistance were indicated as important advantages by contract producers. In contrast, independent producers, who had little firsthand experience with contracting, regarded loss of status, lower returns, and loss of incentive as drawbacks to contract production (52).

Industry members, too, have focused increased attention on the future of the Midwestern egg industry. They suggest some needed changes may have already started.

A recent industry meeting (70) concluded that the "Midwest may have lost a lot of ground to the Southeast in the last decade, but ... their area is far from being out of the egg business." A new industry was seen as emerging in the Midwest that can compete effectively against all other areas. Several necessary steps were outlined. It was indicated that producers are building medium-sized, environmentally controlled houses, and that such units can provide eggs of the quality that is needed. Some industry members believed

production may increase in areas near centers of population since delivery costs are becoming more important. More hatchers and breeders are now becoming associated with producers than in the past. While banker interest and action has been lacking up to now in the Midwest, some changes in this attitude are anticipated. Producers and others are studying mechanization, automation, increased efficiency, land costs, and alternative opportunities. The egg products industry must also change. These needed changes include new product development, better quality eggs, improved packing, and production of eggs strictly for breaking.

According to other observers, changes in the Midwestern egg industry are taking place more rapidly than ever. Contracting is increasing, more laying hens are in cages, production is being concentrated in belts surrounding urban areas, large producing units are becoming more common, and the long-term decline in layer numbers is leveling off. These changes indicate that the loss of local markets in the South and of other distant markets has almost run its course, and a more optimistic future exists for Midwestern producers who have adopted commercial practices (60).

In summary, the position of the Midwest in the egg business has deteriorated, but is not beyond recovery. With present trends, the eventual share of the Midwest in the total egg supply may still decline a bit further. But the extent of this decline is contingent upon quick and decisive action to improve the entire egg producing, input-supplying, and marketing system in the Midwest.

Rogers answers the question, "Is the Midwest going to let the egg industry go to the South?" (63), with 3 yeas and 3 nays. The egg industry will move from the Midwest to a greater extent if (1) trends in regional shifts continue, (2) the "market-oriented" thesis that all eggs will be produced near consuming centers holds true, and (3) input-supplying and marketing systems are not changed. The egg industry will not move out if (1) rates of change in various factors, including wage rates and rates of lay per bird, become stabilized, (2) egg production is a profitable alternative for Midwestern farmers, and (3) the structure of the Midwestern egg industry changes fast enough.

The result may not be a complete pattern of "egg sheds." Undoubtedly, smaller markets will be increasingly supplied by large, nearby, and more highly integrated arrangements. But there will still be substantial movements from surplus to deficit areas. It is probably in long-distance movements to deficit areas that the Midwest has lost much of its former preeminent position, and here the Midwest must do better to avoid further retrenchment.

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APPENDIX I: DEMAND ANALYSES

To identify more precisely the major factors influencing or associated with the price of eggs and to quantify the impact of these forces, statistical relationships were developed with annual data for 1955-64. Price-estimating equations were fitted by the least squares method for three principal markets--New York City, Iowa, and Chicago--and for the United States as a whole.

The basic mathematical model used was of the form: $P=f(S,L,Y,T)$ Where P is the price of eggs, S the supply of shell eggs available for food, L the supply of liquid egg available for food, and Y consumer income. Egg supplies and income were divided by population so population would not have to be considered as a separate variable. Several sets of relationships were developed, but detailed results are shown only for 4 of these. In the first, the total per capita egg supply for food was used, that is, the sum of S and L. In the second, third, and fourth sets, S and L were treated as separate variables.

First Set of Analyses

In these analyses, factors found to influence the price of eggs were (1) per capita farm egg supplies for food, (2) per capita disposable income, and (3) a downward shift in demand, measured by time. These three factors explained much of the variation in the prices examined--74 percent in U.S. average prices, 87 percent in Iowa prices, 87 and 91 percent in Chicago prices, and 92 percent in New York prices. The equations which included both income and time as shift variables explained a larger percentage of the variation in egg prices than those including income or time alone. The improvement over the use of time alone ranged from mostly 3 to 5 percentage points but for U.S. prices it was 14 points. The improvement over the use of income alone was about twice as great. As expected, egg prices varied inversely with supplies and directly with income and declined with the passage of time. However, income was not statistically significant at the 5 percent probability level in all cases and time was significant only for New York and Iowa.

These analyses indicated that a change in total per capita supplies of 1 percent, all other things being equal, was associated with a 4 to $5\frac{1}{2}$ percent (about $1\frac{1}{2}$ to 2 cents per dozen) change in egg prices in the opposite direction. The analyses also indicated that with egg supplies and income held constant, egg prices tended to decline from year to year by 12 to 18 percent, depending on the price series used. On the other hand, egg prices tended to rise 2 to 3 percent for each 1 percent rise in per capita disposable income. Per capita disposable income increased an average of 4 percent per year in 1955-64. The opposing effects of both time and income on prices undoubtedly are exaggerated.

Shifts in the demand for eggs can be conveniently grouped under two headings. On the one hand, there has been a steady decline in demand resulting from changes in living and working patterns associated with growth in real income and rising standards of living. These longer term changes are highly correlated with the passage of time. On the other hand, short-run shifts in

the demand schedule might be expected to result from sudden changes in per capita income. Further, the passage of time is closely correlated with growth in consumer incomes (r^2=.97). The use of income and time as explanatory variables gives no assurance that they can statistically isolate the separate impact of trend and income on egg prices.

With the first set of equations, it was possible to estimate prices that fell within about 1½ cents per dozen of the observed prices in 2 out of every 3 years and within 3 cents almost every year (table 17). The Durbin-Watson tests revealed a high degree of negative autocorrelation in the disturbance terms. That is, if the equations in one year yielded prices above observed values, they were likely to estimate prices below observed values the following year. Prices in this analysis appear to exhibit inertia with respect to changes in demand conditions. They respond somewhat slowly at first to a change in conditions and continue responding for a while in the same direction even after these conditions have been reversed.

Second Set of Analyses

This set of analyses, in which the total per capita egg supply was divided into a shell and a liquid component, was successful in explaining a much greater proportion of the variation in egg prices than the one using only the one supply variable. Three factors, (1) per capita shell egg supplies, (2) per capita liquid egg supplies, and (3) the decline in demand, measured by time, explained 96 to 98 percent of the variation in the egg prices studied. Each of the factors proved to be highly significant statistically.

Changes in liquid egg supplies had roughly the same impact on all price series, but changes in shell egg supplies affected the prices for large, high-quality eggs the most, low-quality eggs in Chicago somewhat less, and the average price received by U.S. producers for all eggs the least. It would be expected that prices of top-quality eggs would be more sensitive than prices of low-quality eggs to changes in shell egg supplies for food. The reason for this is that shell egg supplies represent high-quality eggs whereas most eggs broken commercially are of lower quality. In addition, when egg supplies are tight and prices are high, low-quality eggs make up a larger proportion of total output. The reason for this is that, under these circumstances, egg producers hold their older layers (which lay more low-quality eggs) in production longer to capitalize on the high prices. Thus, when egg prices remain high for several months, low-quality eggs become relatively more plentiful and lower in price compared with high-quality eggs. Just the opposite pattern occurs when egg prices are relatively low--the decline in prices for low-quality eggs is cushioned.

The impact of shell egg supplies on prices of all eggs sold by farmers, is further neutralized by changes in the proportion of different sizes and kinds of eggs, some of which have price patterns that are related to factors not included in these analyses. The prime example is the price of hatching eggs, which is determined largely by the demand for chicks and often moves counter to the price of market eggs.

The study also showed that the demand for processed egg is less elastic than the demand for shell eggs. That is, changes in liquid egg supplies affect prices more than equivalent changes in shell egg supplies. In the usual range of prices, one would expect the demand for egg products to be highly inelastic.

In the second set of relationships, the downtrend in the demand for eggs was associated both with the passage of time and with a shift toward a greater utilization of eggs in processed products. The time-trend factor, assuming no change in per capita supplies, tended to reduce the price of eggs 2 to 3 cents per dozen per year, about 4 to 8 percent, depending on the price series. On the other hand, a shift of 1 percent of total egg supplies from the shell to the processed component was associated with a decline of about $\frac{1}{2}$ to $1\frac{1}{2}$ cents per dozen in egg prices. Liquid supplies in 1965 made up 10 percent of total egg supplies for food compared with 8 percent in 1955.

The analyses also confirm that it has been principally the downward shift in the demand for shell eggs for food rather than for processed egg that has been responsible for the decline in egg prices in recent years. Drops in shell egg demand appear to have lowered the total demand for eggs, lowered the egg price level, and encouraged a larger proportion of total supplies to be consumed as processed products.

Third Set of Analyses

These equations differ from the second set of analyses in that per capita income rather than time is used as a demand shifter. This substitution resulted in very little change over the second set in the percentage of price variation explained, the equations' ability to estimate prices, and the price flexibility coefficients for liquid egg supplies (table 17). However, for shell egg supplies the price flexibility coefficients were about cut in half. This change indicates the danger involved in placing too great a reliance on estimates of individual parameters in the equations which prove to be unstable. The third set of analyses confirms the three major conclusions of the first two sets. These conclusions are: (1) There has been a downward shift in demand, probably related to changing living patterns, that has more than offset any price-boosting effect associated with rising incomes; (2) the demand for eggs is highly inelastic; and (3) the demand for liquid egg is much more inelastic than the demand for shell eggs. In addition, the third set suggests that differences in the elasticity of demand for shell and processed egg may be wider than is implied by the second set. Details of these analyses are shown in table 17.

Fourth Set of Analyses

Another set of relationships was run, using shell and liquid supplies, income, and time as independent variables. These, also shown in table 17, explain about the same percentages of variations in egg prices as the comparable sets using time or income alone. Coefficients for shell egg supplies in this set of analyses are higher than for comparable analyses with income alone

but lower than for analyses with price alone. Income and time in these analyses are not significant at the 5 percent probability level.

The equations developed in this study do not estimate or forecast supplies, but do provide relationships for forecasting prices when supplies are assumed or can be estimated from the number of layers on farms, the number of replacement chicks hatched, and projections of the rate of lay. The first set of equations probably would be the easier ones to use for predictive purposes because total egg supplies for food are more readily forecast than are shell and liquid supplies. The analyses also provide some basis for evaluating the probable impact of Government egg purchases.

Table 17.--Relationship of egg prices in New York, Chicago, Iowa, and the United States to U.S. per capita supplies and factors associated with changes in demand, 1955-64

Price series	Factor by which variable is multiplied 1/			Factor to be added 3/	Durbin-Watson test 4/	Standard error of estimate	Percentage of explained variation 5/
	Per capita						
	Total egg supply for food 2/	Disposable income	Time 1955=1				
First set of analyses:							
New York, wholesale, large, white, 10 percent AA quality or better ..	-186*	0.034#	-5.31*	178.5	3.66	1.4	92
Chicago, delivered, large, mixed colors, 60-79.9 percent A quality or better	-191*	.045#	-5.43#	158.5-155.8	3.04	1.4	91
Chicago, delivered, large, mixed colors, 20 percent B quality or better	-189*	.031#	-4.24#	172.7	2.97	1.5	87
Iowa, received by farmers, farm run, white, A quality or better	-186*	.032*	-4.78#	167.3	3.77	1.3	87
U.S., received by farmers, all eggs	-165*	.050#	-5.56#	122.4	3.42	1.7	74
	Factor by which variable is multiplied 1/			Factor to be added 3/	Durbin-Watson test 4/	Standard error of estimate	Percentage of explained variation 5/
	Per capita supplies for food						
	Shell eggs 6/	Liquid eggs 7/	Time 1955=1				
Second set of analyses:							
New York, wholesale, large, white, 10 percent AA quality or better ..	-156&	-232&	-2.78&	210.3	1.76	.7	98
Chicago, delivered, large, mixed colors, 60-79.9 percent A quality or better	-121*	-252&	-1.92&	171.2-170.1	2.12	.7	98
Chicago, delivered, large, mixed colors, 20 percent B quality or better	-149*	-258&	-1.98&	192.6-190.9	2.64	.8	96
Iowa, received by farmers, farm run, white, A quality or better	-164&	-234&	-2.45&	202.1	2.00	.4	98
U.S., received by farmers, all eggs	-79.5*	-233&	-1.29&	130.6	2.31	.6	97

See footnotes at end of table

Table 17.--Relationship of egg prices in New York, Chicago, Iowa, and the United States to U.S. per capita supplies and factors associated with changes in demand, 1955-64--Continued

Price series	Factor by which variable is multiplied 1/			Factor to be added 3/	Durbin-Watson test 4/	Standard error of estimate	Percentage of explained variation 5/
	Per capita supplies for food: Shell eggs 6/	Liquid eggs 7/	Per capita disposible income				
Third set of analyses:							
New York, wholesale, large, white, 10 percent AA quality or better	-75.9&	-222&	-0.029&	182.6	2.38	0.7	98
Chicago, delivered, large, mixed colors, 60-79.9 percent A quality or better	-53.6#	-255&	-.019&	141.3-140.9	1.97	.8	97
Chicago, delivered, large, mixed colors, 20 percent B quality or better	-87.0*	-263&	-.021&	170.1-169.0	2.34	.7	97
Iowa, received by farmers, farm run, white, A quality or better	-93.5&	-225&	-.026	178.9	2.49	.4	98
U.S., received by farmers, all eggs	-41.6*	-228&	-.013&	117.1	2.49	.6	97

	Factors by which variable is multiplied 1/				Factor to be added 3/	Durbin-Watson test 4/	Standard error of estimate	Percentage of explained variation 5/
	Per capita supplies for food: Shell eggs 6/	Liquid eggs 7/	Time 1955=1	Per capita disposable income				
Fourth set of analyses:								
New York, wholesale, large, white, 10 percent AA quality or better	-127&	-230&	-1.65#	-0.012#	202.8	2.11	0.7	98
Chicago, delivered, large, mixed, colors, 60-79.9 percent A quality or better	-119#	-252&	-1.85#	-.008#	170.5-169.5	2.11	.8	98
Chicago, delivered, large, mixed colors, 20 percent B quality or better	-105#	-262&	-.51#	-.016#	178.1-176.8	2.47	.8	97
Iowa, received by farmers, farm run white, A quality or better	-131&	-231&	-1.23#	-.013#	194.0	2.59	.3	99
U.S., received by farmers, all eggs	-68.8	-232&	-.88#	-.004#	128.0	2.40	.6	97

1/ Multiple correlation coefficients. 2/ Farm egg production plus January 1 stocks minus eggs used for hatching divided by total population. 3/ Constant value in the regression equation. For Chicago, top number to be used for 1955-58 and bottom number thereafter. This allows for change in level of reporting from wholesale to delivered basis. 4/ Measure used to judge the serial correlation in disturbance term. In the first set of analyses, these indicate that the hypothesis of random disturbances is rejected. 5/ Coefficient of determination times 100. 6/ Farm egg production plus stocks of shell egg minus eggs broken commercially and used for hatching. 7/ Liquid egg production plus stocks of frozen egg. *Significant at the 5 percent probability level. #Not significant at the 5 percent probability level. &Significant at the 1 percent probability level.

Table 18.--Date used in annual egg analyses, 1955-64

Year	Per capita supply for food: Total eggs 1/	Per capita supply for food: Shell eggs 2/	Per capita supply for food: Liquid eggs 3/	Time, 1955=1	Per capita disposable income	Dummy variable for Chicago prices 4/	Egg prices per dozen: New York, wholesale, large, white, 10 percent AA quality or better	Egg prices per dozen: Chicago: Delivered, large, mixed colors, 60-79-9 percent A quality or better	Egg prices per dozen: Chicago: Delivered, large, mixed colors, 20 percent B quality or better	Egg prices per dozen: Iowa, received by farmers, farm run, white, A quality or better	Egg prices per dozen: U.S. received by farmers, all eggs
	Cases				Dollars		Cents				
1955	0.97	0.89	0.08	01	1,666	0	49.1	42.1	37.0	35.1	39.5
1956	.98	.89	.08	02	1,743	0	46.8	39.8	35.4	32.6	39.3
1957	.96	.88	.09	03	1,801	0	44.4	37.4	32.4	30.4	35.9
1958	.94	.86	.08	04	1,831	0	45.9	38.6*	34.9*	33.0	38.5
1959	.95	.84	.11	05	1,905	1	38.6	30.9	26.7	26.3	31.4
1960	.91	.82	.09	06	1,937	1	44.5	37.0	32.9	32.2	36.0
1961	.89	.80	.10	07	1,983	1	42.8	35.3	32.4	30.9	35.5
1962	.90	.80	.10	08	2,064	1	40.1	33.2	29.4	28.4	33.6
1963	.88	.80	.09	09	2,132	1	39.1	34.0	31.4	28.4	34.4
1964	.89	.79	.09	10	2,269	1	37.5	32.8	29.1	26.8	33.8

1/ Farm egg production plus January 1 stocks minus eggs used for hatching.
2/ Farm egg production plus stocks of shell eggs minus eggs broken commercially and eggs used for hatching.
3/ Liquid egg production plus stocks of frozen egg.
4/ Reporting changed from wholesale to delivered level in 1959.

*Partly estimated.

Table 19.--Egg production on farms: Index numbers of seasonal variation for United States and regions, specified years 1950-64
(Average for each year=100)

Area	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
United States												
1950	104	106	128	125	120	102	92	82	78	83	85	95
1955	105	100	120	114	112	98	93	87	85	92	93	101
1960	103	97	112	109	109	100	97	94	90	94	94	101
1964	101	97	110	108	108	100	99	95	92	95	95	100
Regions												
North Atlantic:												
1955	106	96	107	102	101	94	94	96	95	102	101	106
1960	103	93	105	102	104	97	98	98	96	101	99	104
1964	102	92	104	102	104	99	99	98	96	101	99	104
East N. Central:												
1955	110	100	117	112	110	97	90	84	83	92	98	107
1960	105	96	110	108	108	98	96	93	88	94	98	106
1964	104	95	109	107	107	99	98	94	90	95	98	104
West N. Central:												
1955	111	105	123	120	117	100	90	82	75	83	90	104
1960	110	103	117	114	112	100	94	87	81	86	91	105
1964	109	102	116	111	111	100	96	89	83	87	92	104
South Atlantic:												
1955	101	102	123	118	114	99	92	87	87	92	89	96
1960	100	96	112	110	109	99	97	95	92	96	95	99
1964	99	95	110	108	109	99	98	96	94	97	96	99
South Central:												
1955	93	100	131	127	122	103	95	87	84	89	83	86
1960	94	96	117	116	116	103	99	94	91	94	89	91
1964	93	95	115	114	113	103	100	96	92	96	91	92
West:												
1955	102	95	110	106	106	98	97	97	94	99	96	100
1960	100	93	105	103	106	100	101	100	98	100	96	98
1964	99	92	104	102	105	101	102	101	99	101	96	98

Table 20.--Number of layers on farms: Index numbers of seasonal variation for United States and regions, specified years 1950-64
(Average for each year=100)

Area	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
United States												
1950	112	109	105	100	95	91	86	86	93	102	109	112
1955	109	106	103	99	95	92	89	91	97	103	107	109
1960	105	103	101	99	97	94	94	95	99	102	105	106
1964	104	102	101	99	97	96	95	96	99	102	104	105
Regions												
North Atlantic:												
1955	107	103	99	95	92	91	92	97	102	106	108	108
1960	104	101	99	97	95	94	95	98	102	105	105	105
1964	103	101	99	98	96	95	96	98	101	103	105	105
East N. Central:												
1955	110	107	103	99	95	90	87	88	98	104	109	110
1960	106	104	101	99	96	93	92	95	98	103	106	107
1964	105	103	101	99	97	95	94	96	98	102	104	106
West N. Central:												
1955	111	109	106	101	96	91	86	86	93	102	108	111
1960	108	107	104	101	97	93	90	89	95	101	106	109
1964	107	106	104	100	97	94	92	90	96	101	105	108
South Atlantic:												
1955	108	105	102	99	96	93	92	93	97	102	106	107
1960	104	103	101	99	97	95	94	96	99	102	104	106
1964	103	101	101	100	97	96	95	97	100	102	103	105
South Central:												
1955	107	104	102	99	96	93	91	92	98	104	106	108
1960	105	103	102	99	97	95	94	95	99	102	104	105
1964	103	102	101	100	98	96	97	97	99	102	103	104
West:												
1955	105	103	101	98	96	94	94	96	100	103	105	105
1960	102	101	100	99	98	98	97	99	101	102	102	101
1964	100	100	99	100	99	98	98	100	101	102	102	101

Table 21.--Eggs produced per 100 layers on farms: Index numbers of seasonal variation for United States and regions, specified years 1950-64
(Average for each year=100)

Area	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
United States												
1950	93	96	120	124	126	113	105	95	83	81	79	85
1955	97	94	115	115	118	107	103	96	87	88	87	93
1960	97	93	110	110	113	105	104	99	91	92	90	96
1964	97	93	108	108	111	105	104	99	93	94	92	96
Regions												
North Atlantic:												
1955	99	93	108	107	110	102	102	98	93	96	94	98
1960	99	92	105	105	109	103	103	100	94	97	95	98
1964	99	91	104	105	109	104	103	100	95	97	95	98
East N. Central:												
1955	99	94	113	113	117	107	102	94	86	88	90	97
1960	99	93	108	109	112	105	103	98	90	92	92	99
1964	99	92	108	108	111	105	103	99	91	93	93	98
West N. Central:												
1955	99	96	116	118	121	111	104	94	82	81	84	94
1960	100	96	113	113	116	108	105	96	85	85	86	97
1964	100	96	112	111	114	107	104	97	88	87	88	96
South Atlantic:												
1955	94	96	120	118	118	106	101	95	89	89	84	90
1960	96	93	111	111	113	104	103	98	92	94	91	94
1964	97	93	109	108	111	104	103	99	93	95	93	95
South Central:												
1955	87	95	125	127	127	111	104	94	86	86	78	80
1960	89	93	115	117	119	108	104	99	92	92	85	87
1964	90	95	113	114	116	107	104	99	93	94	88	89
West												
1955	97	92	109	107	110	104	104	100	94	96	92	95
1960	98	92	105	104	107	103	104	101	97	99	94	96
1964	98	92	104	102	107	102	104	102	97	100	95	97

Table 22.--Prices received by farmers for eggs: Index numbers of seasonal variation, by regions and selected markets, specified years 1950-64
(Average for each year=100)

Area	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
United States												
1950	98	88	89	90	89	91	98	105	111	116	116	109
1955	101	93	94	94	91	90	97	104	109	109	110	108
1960	103	103	100	93	90	87	93	99	107	109	109	107
1964	104	106	100	93	88	87	93	100	106	109	108	106
Regions												
New England:												
1955	95	93	100	99	93	93	103	108	111	106	104	95
1960	96	100	106	95	90	88	101	107	110	103	107	97
1964	98	102	105	92	86	87	104	108	109	102	109	98
Middle Atlantic:												
1955	98	93	94	93	86	88	95	107	114	113	112	107
1960	101	101	100	92	85	86	92	102	112	110	112	107
1964	103	104	99	91	83	87	91	102	111	110	112	107
East N. Central:												
1955	97	94	96	96	91	89	93	100	111	113	113	107
1960	101	103	103	94	90	87	92	97	107	110	110	106
1964	104	106	103	94	88	87	92	98	105	109	109	105
West N. Central:												
1955	96	93	101	101	99	95	97	99	107	106	104	102
1960	97	104	105	97	94	90	94	97	106	107	106	103
1964	99	107	103	95	92	90	93	100	104	108	105	104
South Atlantic:												
1955	108	99	89	87	86	90	96	102	108	110	112	113
1960	107	104	98	91	87	89	94	99	105	108	109	109
1964	106	106	100	92	86	88	94	100	104	108	108	108
East S. Central:												
1955	109	99	89	87	87	88	94	99	106	109	113	120
1960	111	106	97	89	89	88	92	95	102	108	110	113
1964	112	107	98	91	89	88	92	95	101	107	109	110

Table 22.--Prices received by farmers for eggs: Index numbers of seasonal variation, by regions and selected markets, specified years 1950-64--Continued
(Average for each year=100)

Area	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
West S. Central:												
1955	113	102	89	87	87	86	90	96	106	109	114	121
1960	112	106	95	89	89	87	89	94	103	108	112	116
1964	112	107	97	91	88	87	90	96	103	107	110	112
Mountain:												
1955	106	94	91	90	88	87	94	104	111	109	111	115
1960	105	101	97	92	89	86	94	101	108	108	109	110
1964	107	105	99	93	87	87	93	99	106	108	108	108
Pacific:												
1955	103	97	100	97	93	90	94	102	103	105	106	110
1960	109	107	101	96	88	83	90	98	104	107	107	110
1964	111	111	102	95	86	83	88	96	104	107	107	110
Selected Markets:												
Iowa, Grade A or better:												
Large:												
1960	95	98	97	87	84	85	94	102	120	118	115	105
1964	101	101	96	86	82	84	93	105	117	117	112	106
Medium:												
1960	104	109	110	95	90	87	94	94	109	104	99	105
1964	109	113	107	94	88	85	90	98	109	106	97	104
Chicago, delivered, minimum 60-80% A, mixed colors:												
Large:												
1955	95	94	95	91	88	89	100	106	117	115	111	99
1960	96	98	97	89	85	87	94	102	118	117	112	105
1964	102	99	95	88	82	86	94	105	117	115	111	106

Table 22.--Prices received by farmers for eggs: Index numbers of seasonal variation, by regions and selected markets, specified years 1950-64--Continued

Area	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Medium:												
1955	102	104	104	98	93	93	99	104	108	96	98	101
1960	104	110	106	95	88	88	97	98	114	98	97	105
1964	113	111	105	94	85	85	94	100	112	100	95	106
New York wholesale, large white, minimum 10% AA:												
1955	91	87	91	91	84	90	104	116	122	115	111	98
1960	95	96	94	85	80	86	100	109	121	113	115	106
1964	98	99	94	82	80	86	97	110	120	111	115	108
Minimum 60-70% A:												
1955	93	91	95	93	88	89	99	107	119	116	112	98
1960	96	97	97	88	85	87	96	104	118	114	113	105
1964	100	100	96	86	83	87	95	107	116	112	112	106
San Francisco, Grade A in cartons, delivered to retailers:												
Large:												
1960	106	104	98	91	87	86	97	104	109	105	105	108
1964	108	105	99	91	87	88	94	100	110	106	105	107
Medium:												
1960	108	107	101	93	86	83	90	100	106	106	105	115
1964	114	110	100	91	87	82	88	96	106	106	106	114
Small:												
1960	122	117	106	97	85	80	80	82	95	104	110	122
1964	121	113	107	94	85	81	82	84	95	106	110	122

Table 23.--Variability in indexes of seasonal variation of egg prices, by regions and selected markets, specified years 1950-64

Item	1950	1955	1960	1964
United States	10.9	7.7	7.7	7.9
Regions				
New England	---	6.3	7.0	8.1
Middle Atlantic	---	10.0	9.5	9.8
East North Central	---	8.7	7.9	7.9
West North Central	---	4.4	5.8	6.2
South Atlantic	---	10.2	8.1	8.1
East South Central	---	11.3	9.4	8.8
West South Central	---	12.4	10.6	9.6
Mountain	---	10.3	8.3	8.2
Pacific	---	5.9	9.1	10.1
Markets				
Iowa, Grade A or better:				
Large	---	---	12.4	12.2
Medium	---	---	7.9	9.3
Chicago, delivered, minimum 60-80 percent A, mixed colors:				
Large	---	10.0	11.1	11.4
Medium	---	4.7	8.1	9.7
New York wholesale, large white:				
Minimum 10 percent AA	---	13.0	13.0	13.1
Minimum 60-70 percent A	---	10.8	11.0	11.0
San Francisco, Grade A in cartons, delivered to retailers:				
Large	---	---	8.1	8.1
Medium	---	---	9.8	11.0
Small	---	---	15.9	15.1

Table 24.--Variability in indexes of seasonal variation of egg production, number of layers, and rate of lay for 1955, 1960, and 1964, by regions

Item	North Atlantic	East North Central	West North Central	South Atlantic	South Central	West	United States
Egg production:							
1955	4.9	11.3	16.0	12.3	17.3	5.0	11.0
1960	3.7	7.1	12.1	6.6	10.5	3.6	7.0
1964	3.6	6.1	10.7	5.7	9.1	3.6	5.8
Number of layers:							
1955	6.6	8.5	9.4	5.8	6.0	4.2	7.1
1960	4.2	5.3	7.1	3.9	6.1	1.7	4.4
1964	3.5	4.1	6.2	3.2	3.0	1.4	3.5
Rate of lay:							
1955	5.9	10.4	14.1	12.6	18.4	6.6	12.1
1960	5.1	7.4	11.2	8.1	12.2	4.7	8.1
1964	5.2	6.9	9.6	6.7	10.4	4.4	6.9

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